# Annual Report

# FOREST PEST CONDITIONS IN WISCONSIN

## 1967

WISCONSIN CONSERVATION DEPARTMENT
FOREST MANAGEMENT DIVISION
FOREST PESTS — SURVEY AND CONTROL

600-43

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# ANNUAL REPORT

# FOREST PEST CONDITIONS
IN
WISCONSIN
1967

# FOREWARD

The Forest Pest Survey and Control Section has again enjoyed the cooperation and assistance of many individuals and agencies during the course of the year 1967. Thanks to Bureau of Forest Management personnel and all others who have contributed in any way to the survey and control program. Your participation has been appreciated.

Donald W. Renlund, Chief
Forest Pest Survey and Control

# FOREST PEST SURVEY AND CONTROL HEADQUARTERS AND SOUTHERN AREA OFFICE
Nevin Hatchery, Madison

Donald W. Renlund - Chief
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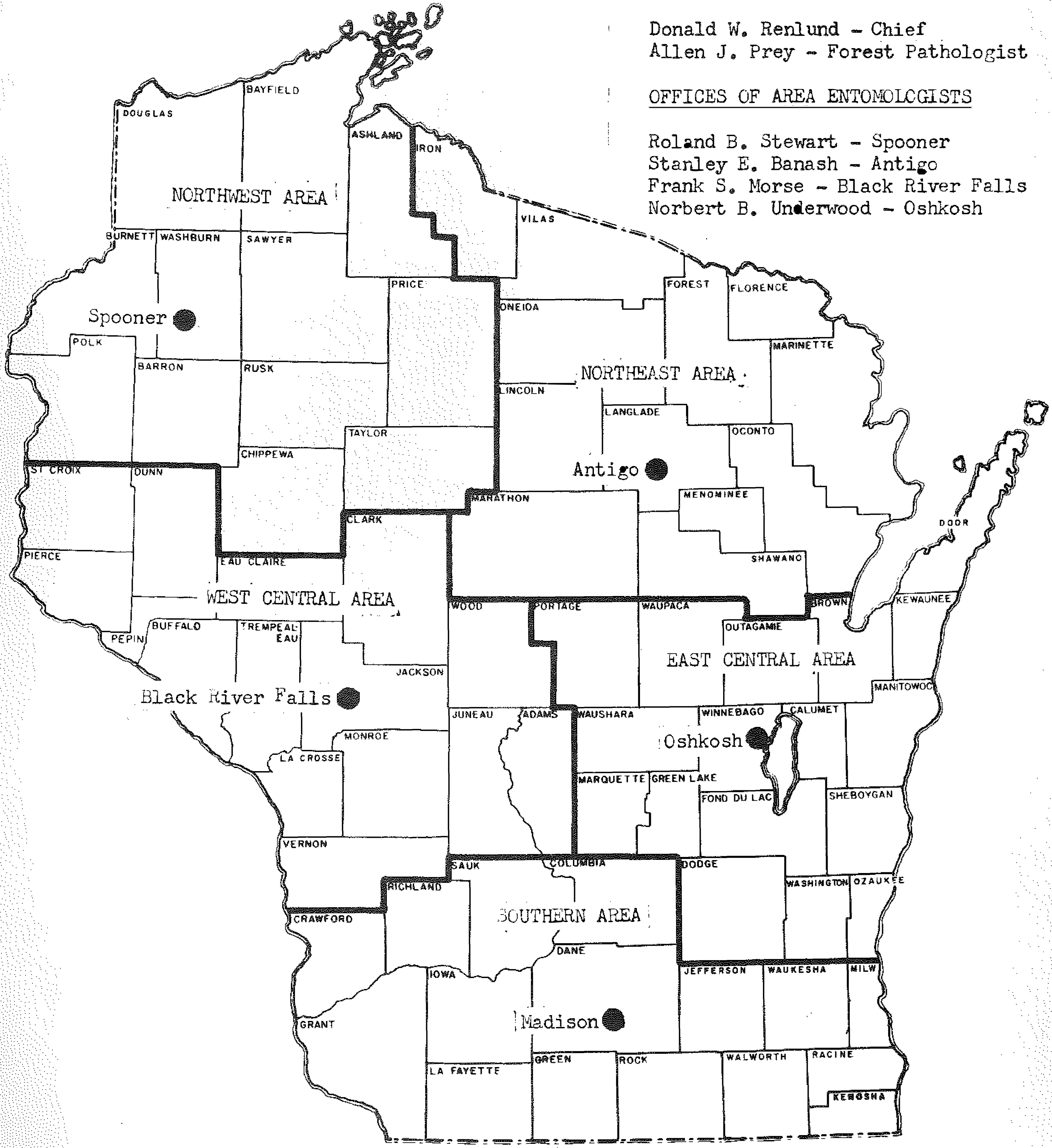

NORTHWEST AREA
NORTHEAST AREA
WEST CENTRAL AREA
EAST CENTRAL AREA
SOUTHERN AREA
Spooner
Antigo
Black River Falls
Oshkosh
Madison
DOUGLAS
BAYFIELD
ASHLAND
IRON
VILAS
BURNETT
WASHBURN
SAWYER
PRICE
ONEIDA
FOREST
FLORENCE
POLK
BARRON
RUSK
MARINETTE
LINCOLN
LANGLADE
OCONTO
TAYLOR
CHIPPEWA
ST CROIX
DUNN
MARATHON
MENOMINEE
DOOR
CLARK
PIERCE
EAU CLAIRE
SHAWANO
WOOD
PORTAGE
WAUPACA
BROWN
KEWAUNEE
PEPIN
BUFFALO
TREMPEALEAU
OUTAGAMIE
JACKSON
MANITOWOC
JUNEAU
ADAMS
WAUSHARA
WINNEBAGO
CALUMET
MONROE
LA CROSSE
MARQUETTE
GREEN LAKE
FOND DU LAC
SHEBOYGAN
VERNON
SAUK
COLUMBIA
DODGE
WASHINGTON
OZAUKEE
RICHLAND
CRAWFORD
DANE
IOWA
JEFFERSON
WAUKESHA
MILW
GRANT
GREEN
ROCK
WALWORTH
RACINE
LA FAYETTE
KENOSHA

# HIGHLIGHTS

Following are highlights of some of the most noteworthy forest insect and conditions in the state during the year. Additional details may be found in the text under the appropriate sections.

## FOREST INSECTS

. Jack-pine budworm activity varied in intensity throughout jack pine areas of the state, and was especially troublesome in parts of Bayfield and Douglas Counties where moderate to complete defoliation occurred on a gross area of approximately 80,000 acres of forest land. Areas of 1,120 acres near Boulder Junction, and 1,600 acres near Conover, both in Vilas County, were also severely defoliated.

. Four insecticides...Dylox, Matacil, Malathion and Zectran were field tested against the jack-pine budworm.

. The pine tussock moth caused little defoliation in 1967, and although egg counts in August indicated localized increases in populations in some localities, no serious defoliation is anticipated for 1968.

. A single colony of forest tent caterpillar larvae was found in Douglas County.

. Most of the hard maple and beech on Rock Island, at the tip of Door County, were completely defoliated by the saddled prominent.

. Zimmerman moth populations remained high in red pine windbreaks and Christmas tree plantings along the Wisconsin River near Boscobel in Grant County.

. The fruit tree leaf-roller severely defoliated 7,680 acres of Hill's oak and red oak in Menominee County, and although it was common on oaks in Bayfield and Douglas it caused little apparent defoliation.

. Several moderately infested balsam fir Christmas tree plantations in Langlade County were treated for control of the balsam gall midge. The degree of control achieved was variable.

. Evidence of the red-pine needle midge was widespread in West Central Area counties following a quiescent period of several years.

. The pine root weevil continues to be a major pest in old-field jack pine plantations in the West Central Area.

. Growers of Scotch pine Christmas trees in the West Central Area are troubled by the root collar weevil.

. Bark beetle attacks resulted in the death of single trees and small groups of trees in several red pine plantings in the Northeast Area.

. Mortality of Hill's oak appeared in Menominee County in a new area which had been logged recently, and continued around the periphery of another in the same county where oaks died last year. Evidence indicates that two-lined chestnut borers are involved in the decadence of the trees.

. Most larch stands in the northwest counties showed signs of defoliation and oviposition injury by the larch sawfly. A few scattered stands were severely defoliated in the Northwest and Northeast Areas, while defoliation in the West Central Area was moderate.

. Severe defoliation of open-growing and ornamental white pine by the introduced pine sawfly did not appear until late in the season in west central and northwest counties.

. A single isolated infestation of jack pine by Swaine jack pine sawfly was observed near Mazomanie in Dane County. A 300-foot-long windbreak was completely defoliated.

. Heavy infestations of red-headed pine sawfly on red pine were reported from north central Vilas County.

- Pine spittlebug infestations were heavy on jack pine at several locations in northwest and west central counties. No apparent injury occurred to the trees.

- Two thousand acres of susceptible red pine plantations were surveyed to determine the need for chemical control of the Saratoga spittlebug. Landowners treated 231 acres of young trees in the Northeast Area.

- Pine tortoise scale infestations were heavy on natural jack pine and on Scotch pine in some Northeast Area counties.

- Defoliation by walkingsticks and the post oak grasshopper was relatively light in Marinette and Menominee Counties.

## FOREST DISEASES

- A survey to determine if western gall rust was present in Wisconsin was made in the spring of 1967. Dr. W. T. McGrath, a recent graduate in Plant Pathology from the University of Wisconsin, found the rust in 52 of 284 spore collections made at 124 locations.

- Dr. McGrath also conducted a Scleroderris pine canker survey in the fall which revealed the disease in four red pine plantations in Bayfield County.

- A needle rust damaged balsam fir Christmas trees at several locations.

- Nine elms in Menominee County were found to be infected with Dutch elm disease. The first confirmed infected trees were also found in Oneida and Langlade Counties.

- Winter injury and damage from road salt was evident statewide on conifers during the winter of 1966-67.

- Air pollution damage to trees was reported at several different locations throughout the state.

## MAJOR FOREST INSECTS

### COLEOPTERA

Bronze Birch Borer - Agrilus anxius Gory

Tree and branch mortality were common on ornamental white birch in the vicinity of Spooner (Washburn County). Shade and ornamental trees in the East Central Area were also injured.

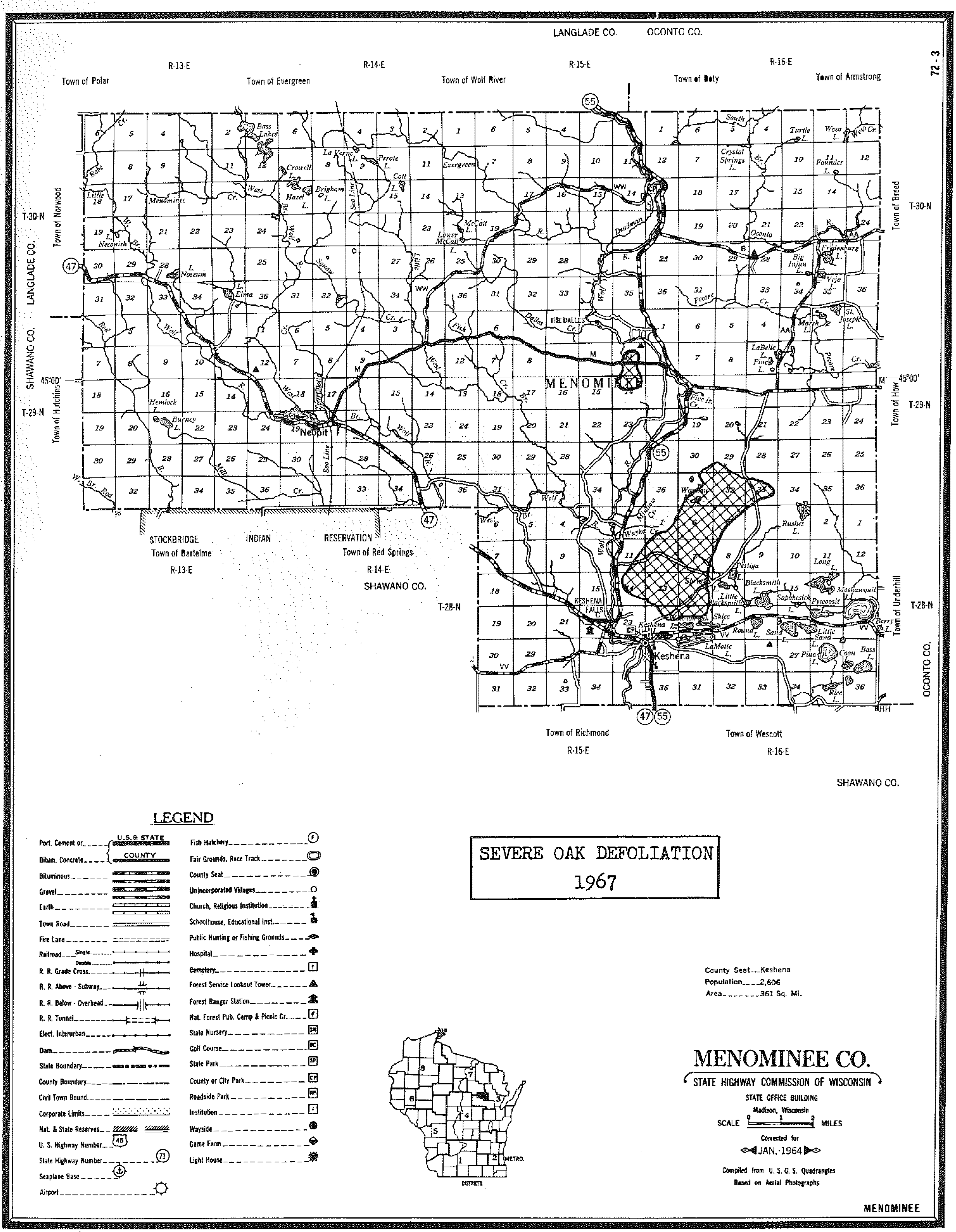
Two-Lined Chestnut Borer - Agrilus bilineatus (Weber)

Northeast Area - Oak mortality continued around the periphery of an area where jack oak (Quercus ellipsoidalis E. J. Hill) has been dying in southeast Menominee County for the past several years. The location, which involved parts of Sections 2, 9, 10, 11, 12, 13 and 14 of T28N, R16E, has repeatedly been defoliated to varying degrees by walkingsticks in odd-numbered years. Affected trees showed evidence of attack by borers, presumably two-lined chestnut borers. (See map on page 5).

Mortality of scrub oak, which involved the chestnut borer, occurred in another location in Section 6, T28N, R16E. Red oak did not appear to be affected in this recently logged section.

West Central Area - Although oaks continued to die in places where tree mortality followed attacks by the chestnut borer, loss of trees was much less than in 1966. Most of the damage occurred to inferior jack oak on poor sites. Many dying trees were observed in southwestern Wood County and northern Adams County.

East Central Area - The borer was most prevalent in Marquette and Green Lake Counties in red and black oaks which were reduced in vigor by unfavorable growing conditions. Older trees showed evidence of previous borer attacks which were severe enough to reduce the value of logs which appeared sound externally.



SEVERE OAK DEFOLIATION
1967

LANGLADE CO.
OCONTO CO.
72-3
MENOMINEE
R-13-E
R-14-E
R-15-E
R-16-E
Town of Polar
Town of Evergreen
Town of Wolf River
Town of Boty
Town of Armstrong
Town of Norwood
Town of Breed
T-30-N
T-29-N
T-28-N
LANGLADE CO.
SHAWANO CO.
Town of Hutchins
Town of How
45°00'
Town of Underhill
OCONTO CO.
MENOMINEE
Neopit
THE DALLES
KESHENA FALLS
Keshena
Bass Lakes
La Verne L.
Perote L.
Crowell L.
Brigham L.
Hazel L.
Colt L.
Evergreen
McCall L.
Lower McCall L.
Little 18
Neconish L.
L. Noseum
L. Elma
Hemlock L.
Burney L.
Turtle L.
Weso L.
Crystal Springs L.
Founder L.
Oconto
Big Injun L.
Fredenburg L.
Vejo L.
Pecore
St. Joseph L.
Marsh L.
LaBelle L.
Pine L.
Five Is.
Rushes L.
Long L.
Pestiga L.
Blacksmith L.
Little Blacksmith L.
Sapokesick L.
Moshawquit L.
Pywoosit L.
Berry L.
Shice L.
Round L.
Sand L.
Little Sand L.
LaMotte L.
Pine L.
Coon L.
Bass L.
Rice L.
Wolf R.
Red R.
West Br.
Fish Cr.
Dalles Cr.
Dead man Cr.
Wayka Cr.
Mill Cr.
Soo Line
STOCKBRIDGE INDIAN RESERVATION
Town of Bartelme
Town of Red Springs
SHAWANO CO.
Town of Richmond
Town of Wescott
SHAWANO CO.
47
55
LEGEND
Port. Cement or Bitum. Concrete — U.S. & STATE — COUNTY
Bituminous
Gravel
Earth
Town Road
Fire Lane
Railroad — Single — Double
R. R. Grade Cross.
R. R. Above - Subway
R. R. Below - Overhead
R. R. Tunnel
Elect. Interurban
Dam
State Boundary
County Boundary
Civil Town Bound.
Corporate Limits
Nat. & State Reserves
U. S. Highway Number 45
State Highway Number 73
Seaplane Base
Airport
Fish Hatchery
Fair Grounds, Race Track
County Seat
Unincorporated Villages
Church, Religious Institution
Schoolhouse, Educational Inst.
Public Hunting or Fishing Grounds
Hospital
Cemetery
Forest Service Lookout Tower
Forest Ranger Station
Nat. Forest Pub. Camp & Picnic Gr.
State Nursery
Golf Course
State Park
County or City Park
Roadside Park
Institution
Wayside
Game Farm
Light House
County Seat...Keshena
Population....2,606
Area........351 Sq. Mi.
DISTRICTS
METRO.
MENOMINEE CO.
STATE HIGHWAY COMMISSION OF WISCONSIN
STATE OFFICE BUILDING
Madison, Wisconsin
SCALE 0 1 2 MILES
Corrected for
JAN. 1964
Compiled from U. S. G. S. Quadrangles
Based on Aerial Photographs
MENOMINEE

Pales Weevil - Hylobius pales (Herbst)

Damage consisting of twig mortality from adult feeding and occasional tree mortality from root injury by larvae continued in Scotch pine Christmas tree plantations in Adams, Jackson, Monroe, Trempealeau and Wood Counties.

Pine Root Collar Weevil - Hylobius radicis Buchanan

No new infestations were reported in the Northwest Area in 1967, but tree mortality is still occurring in Scotch and red pine plantings, primarily Christmas tree plantations.

Little new damage was reported from the West Central Area but Scotch pine Christmas trees, especially neglected stands, are heavily infested. About 20 acres of sapling red pine were treated with Benzene Hexachloride in the Colfax School Forest (Dunn County) to control the weevil infestation reported in 1966.

Planted red and jack pine continued to die in Marquette County (Section 32, T17N, R8E; and Sections 8 and 9, T17N, R10E). Symptoms of infestation are beginning to appear in Waushara County (Sections 30 and 31, T18N, R11E). Adjacent Scotch pine were removed at three sites because the damage appeared to be associated with the presence of the Scotch pine and although the damage appeared to have slowed following removal, it was not stopped.

Pine Root Weevil - Hylobius rhizophagus Millers

New infestations were not observed in the Northwest Area and little mortality was noted in areas of known infestations, although some flagging was found on red pine.

The weevil is a major forest pest in the West Central Area where destruction of many acres of old-field jack pine plantations continues.

Native Elm Bark Beetle - Hylurgopinus rufipes (Eichhoff)

Beetles were collected from a suspect tree in Menominee County (Section 35, T29N, R14E) in which Dutch elm disease was subsequently confirmed. The beetles were preparing brood galleries and eggs were noted in niches on August 4, the date of the observation.

Pine Bark Beetles - _Ips_ sp.

Little damage from bark beetles was encountered in the Northwest, West Central and East Central areas. Damage in the east central counties was restricted to trees that suffered from drought in 1966. Advance reproduction was destroyed in two Jackson County timber sale areas (West Central Area) where pulp operations continued through the summer and wood was left in piles until bark beetles had emerged.

Three minor infestations of bark beetles were reported in young red pine plantings in the Northeast Area. A half-acre of fifteen-year-old trees was killed on a good site in Florence County (Section 12, T39N, R18E). Individual trees and small groups of ten to twelve-year-old red pine were killed on a quarter acre in Vilas County (Trout Lake Headquarters, Department of Natural Resources) and two patches of ten-year-old trees, between a quarter-acre and half-acre in size, were killed by the insects where there was little evidence of other causal agents in Shawano County (Section 8, T27N, R15E, Forty SESW).

White Grubs - _Phyllophaga_ sp.

White grubs were responsible for considerable tree mortality in a balsam plantation in Washburn County (Section 15, T37N, R13W). Apparently the root injury had occurred in 1966 and was not apparent until this year. Few active beetles were noted in the Northwest Area this season.

Flights of beetles were heavy in parts of Shawano County on June 21. Defoliation was apparent on scrub oak in the Town of Wescott north of Shawano Lake.

Oak defoliation, presumably by June beetles, was observed in Juneau County near old sod fields, but no white grub damage to seedlings was reported.

Adults of _Phyllophaga drakii_ Kearby, _Osmoderma eremicola_ Knoch, and _Pelidnota punctata_ (Linnaeus) attracted attention by flying into windows and screens in the Oshkosh area (Winnebago County), and adults of undetermined species were numerous in Richland County.

Pissodes approximatus Hopkins

Damage by this weevil was associated with red pine plantings on poor sites or frost pockets in the Northeast Area. The most severe infestations were found in Marinette, Oneida and Vilas Counties during surveys for Scleroderris lagerbergii (Gremman).

White-Pine Weevil - Pissodes strobi (Peck)

Populations were generally low in all areas of the state. About 10% of the leaders were infested in a small white pine planting in Washburn County (Section 8, T41N, R13W). A few terminals of Norway spruce and Scotch pine Christmas trees were infested in Langlade and Oconto County plantations, and survival of weevils was poor in the east central counties.

Heaviest infestations were reported from the West Central Area where 20% to 30% of the current leaders were infested in a few white pine plantations and averaged 10% to 15%.

Although no white pine weevil control projects were conducted in the West Central Area this year, additional insecticide test plots were established on Black River State Forest plantations.

Further investigation of a reported white pine weevil attack on red pine in Trempealeau County reported in 1966 (p. 7, Annual Report 1966) appears more likely to have been the work of Pissodes approximatus Hopkins. Large numbers of these weevils were found on stumps of red pine, cut for Christmas in the fall of 1966, when the site was re-examined in the spring of 1967. Older stumps showed evidence of previous attacks typical of P. approximatus. Evaluation of evidence available indicated that terminal attacks in 1966 occurred because breeding P. approximatus populations exceeded available stump areas and overflowed to the stems and terminals of living trees.

## DIPTERA

### Balsam Gall Midge - Dasineura balsamicola (Lintner)

Several balsam fir Christmas tree plantations had light to moderate infestations in Langlade and Lincoln Counties and were treated with malathion prior to emergence of the adults. Control varied from poor to excellent. Timing of the insecticide application appeared to be a major factor in the degree of control attained.

Unidentified midge larvae, which were lighter orange-colored and slightly larger than D. balsamicola, were found on exposed surfaces of needles on May 25.

Phenological Notes:

May 17 - Balsam fir buds were about half open on trees growing on ridges and not starting to open on trees in low areas. Adult midges were collected in traps located on crests of ridges.

May 18 - Midges were ovipositing on buds.

May 20 - Balsam new-growth was up to 1/2-inch long and about 40% open on lower slopes.

May 25 - Small larvae were observed in galls on new needles.

### Red Pine Needle Midge - Thecodiplosis piniresinosae Kearby

Damage appeared during early October in many red pine plantations in Buffalo, Clark, Eau Claire, Jackson and Trempealeau Counties. Infestations have been extremely light for several years and were light in most stands in 1967 with only 3 to 10 needle fascicles per twig infested.

The heaviest infestation reported was in Eau Claire County (Section 16, T27N, R8W) where some 15 to 20-foot-tall trees lost 50% of their current needles.

Needles examined in Jackson County on October 4 contained one or two larvae. Most larvae had left the needles by October 12 and none were found on October 25.

Pitch Midge on Jack Pine -

A midge on jack pine was common again this year in northwestern counties, especially in T44N, R11W in Douglas County.

HEMIPTERA

Pine Spittlebug - Aphrophora parallela (Say)

Spittle masses were very conspicuous and numerous throughout the Northwest Area. Some stands in Washburn County (T40N, R11W) and in Douglas County (T44N, R10 & 11W, T45N, R10 & 11W) were so heavily infested that trunks of the jack pine were covered with spittle for several feet. Adult spittlebugs were first noted in Washburn County on June 20.

Scotch pine Christmas tree plantings were seriously affected in Langlade, Lincoln and Shawano (Section 12, T28N, R11E, NWNE) Counties in the Northeast Area and one grower sprayed 40 acres of trees with malathion by helicopter.

Severe flagging of Scotch pine Christmas trees in a Sauk County plantation in the Southern Area (Section 6, T8N, R3E, NESW) left most of the trees on 20 acres unmarketable this year. Branches on jack pine in a roadside park near Gotham in Richland County were heavily covered with spittle while the nymphs were active, but the same trees showed no evidence of injury late in the summer.

Spittle masses were frequently observed on pines in the West Central Area but high concentrations of the insects were not observed and populations were low in the East Central Area.

Saratoga Spittlebug - Aphrophora saratogenis (Fitch)

Populations were very heavy in many young red pine plantations in the Northeast Area. Nymphal surveys conducted on approximately 2,000 acres of plantations in Oneida, Marinette, Oconto, Lincoln and Vilas Counties indicated the need for chemical treatment on 231 acres. The following descriptions were treated with back-pack mistblower application of malathion:

| County | Ownership | Location | Acreage Treated |
|---|---|---|---|
| Oconto | Private | Sections15, 16, T28N, R17E | 60 |
| Marinette | County | Sections 15, 21, T33N, R21E | 7 |
| | | Section 2, T35N, R18E | 17 |
| | | Section 5, T35N, R19E | 13 |
| | | Section 32, T36N, R19E | 3 |
| | | Section 1, T35N, R17E | 3 |
| | | Section 7, T36N, R21E | 12 |
| | | Section 14, T37N, R20E | 7 |
| Lincoln | Private | Sections 24, 25, T35N, R7E | 19 |
| Oneida | Private | Section 36, T39N, R5E | 15 |
| | Nekoosa-Edwards Paper Company | Section 17, T38N, R5E | 60 |
| | Private | Section 36, T39N, R5E | 15 |
| | | Total acres treated | 231 |

Small areas of infestation were present in red pine plantations in Clark, Eau Claire, and Jackson Counties. Populations in Clark County plantations treated in 1966 were almost high enough to require retreatment.

Flagging was observed in Waupace County (Section 2, T25N, R15E) on red pine being sheared for Christmas trees. Good survival and tree growth had suppressed the alternate hosts on an adjacent area, where no shearing had been done.

Spittlebugs presented no problems in the Northwest Area or Southern Area.

Phenological Notes:

June 1 - About 70% of the eggs had hatched in the central part of Oconto County.

July 12 - About 80% of the nymphs were in the fifth instar in Lincoln County.

Eastern Spruce Gall Aphid - Chermes abietes Linnaeus

Galls were numerous on Norway spruce near Horicon (Dodge County) and Montello in Marquette County. Galls were also numerous on white spruce in Langlade County (Section 5, T32N, R13E and Section 24, T31N, R12E).

Pine Bark Aphid - Pineus strobi (Hartig)

Evidence of this insect was scarce in Hayward Nursery (Sawyer County) during 1967.

Pine Tortoise Scale - Toumeyella numismaticum (Pettit and McDaniel)

Populations remained low in the Northwest area where scales were found only on scattered trees, or small groups of trees throughout the area.

From one to five percent of the Scotch pine in Christmas tree plantings in Adams, Clark, Jackson and Wood Counties were infested and the scale was found on scattered natural jack pine in the same counties. The incidence and severity of attack appeared to have increased during 1967 in the West Central Area.

Scotch pine Christmas trees in Marquette County (Section 11, T14N, R10E) and in Green Lake County were heavily blackened by sooty mold which grew on infested trees and also coated adjacent non-infested red pine.

Infestations continued to become more severe in previously affected parts of the Northeast Area. Natural stands of jack pine were heavily infested in Florence and Marinette Counties where the scale killed understory trees and reproduction. Scotch pine Christmas tree plantings were heavily infested in Langlade, Oconto and Oneida Counties and some growers used malathion to kill the new crawlers in late June. Following are locations of serious infestations in northeastern counties:

| | |
|---|---|
| Florence County | Section 12, T39N, R18E |
| Marinette County | Section 7, T33N, R18E |
| Oneida County | Section 14, 23, T35N, R7E |
| Langlade County | Section 17, T34N, R9E |
| | Section 32, T33N, R11E |
| Oconto County | Section 9, T26N, R20E |

Phenological Notes:

May 5 - Scales were active, secreting honeydew in Langlade County.

June 6 - Females heavy with eggs in Marinette County.

July 12 - New crawlers were well settled on new growth of Scotch pine in Langlade County, but some gravid females were also observed and lady beetle larvae were very numerous on the scale-infested trees (Section 17, T34N, R9E).

## HYMENOPTERA

### Introduced Pine Sawfly - Diprion similis (Hartig)

Spring populations caused little apparent defoliation in the Northwest Area but fall-generation larvae were far more numerous and fed well past the middle of September causing severe defoliation in Barron, Polk, Burnett and Washburn Counties on open-grown and ornamental trees.

Generally heavy defoliation of open-grown white pine was reported from Dunn, Pierce and St. Croix Counties by the fall-generation. Larvae and cocoons were observed on other species of pine in other locations in the West Central Area but little noticeable defoliation occurred.

Defoliation was apparent on open-grown white pine in the vicinity of Galloway in eastern Marathon County and southward along Wisconsin highway 49 and County Road "A" to the vicinity of Wild Rose in north central Waushara County in early December. Trees along the edges of some white pine stands also showed evidence of defoliation.

Uppermost branches on an isolated landmark-tree near the center of Griffith Nursery in Wood County were severely defoliated.

Red-Headed Pine Sawfly - Neodiprion lecontei (Fitch)

While only a few colonies were observed in the Northwest Area, reports from various parts of the state indicated that the insect was much more in evidence than it has been for several years.

Scattered colonies were reported in the West Central Area where a few larvae from one colony were still attempting to feed in Jackson County on October 18 after a hard frost had dropped most larvae to the ground.

Several colonies were observed on jack pine in a roadside planting in Winnebago County (Section 5, T20N, R15E) and a red pine planting in Door County (Section 21, T32N, R28E).

Two areas of heavy infestations were reported in the Northeast Area, one covering 18 acres near Tenderfoot Lake in Vilas County, (Section 7, T43N, R8E) and another near Boulder and Roberts Lakes in Oconto County which involved several red pine plantations. The Vilas County plantation was successfully treated with malathion applied at 1/2 pound per acre.

Phenological Notes:

| | | |
|---|---|---|
| July | 14 - | 95% of eggs hatched and stages present included eggs, and 1st and 2nd instar larvae. |
| August | 31 - | Larvae were mature at Star Lake in Vilas County. |
| September | 21 - | Larvae had cocooned in Oconto County. |

Red Pine Sawfly - Neodiprion nanulus nanulus Schedl

A few colonies were reported on ornamental red pine in Shell Lake (Washburn County), and populations were light elsewhere in the state.

White Pine Sawfly - Neodiprion pinetum (Norton)

Reports of activity were scarce. Defoliation of a few individual trees was reported in the Southern Area late in August.

Jack-Pine Sawfly - Neodiprion pratti banksianae Rohwer

Only a few scattered colonies were observed in Douglas County in 1967. None were reported elsewhere.

Larch Sawfly - Pristophora erichsonii (Hartig)

Populations in the Northwest Area were definitely higher than in 1966. Defoliation was spotty throughout the area, but most larch stands examined showed evidence of defoliation and oviposition injury. Many cocoons were destroyed by parasites and predators.

Severe defoliation was noted in scattered stands in Langlade, Oneida and Vilas Counties during aerial and ground surveys in the Northeast Area, and defoliation of West Central Area stands in Clark, Jackson and Wood Counties remained light in most stands, about the same as in 1966.

Scattered colonies of the sawfly were noted in Waushara County where the larvae disappeared before reaching maturity. The only predatory activity observed was that by red-winged blackbirds.

LEPIDOPTERA

Cankerworms - Fall Cankerworm - Alsophila pometaria (Harris)
Spring Cankerworm - Paleacrita vernata (Peck)

Large numbers of cankerworms were observed in Waushara County (Section 29, T19N, R13E) and Waupaca County (Sections 29, 30, T22N, R11E).

Fruit-Tree Leafroller - Archips argyrospila (Walker)

The insect was common on oaks in parts of Douglas and Bayfield Counties, and caused light defoliation in Lucius Woods Park at Solon Springs (Douglas County).

During late June and early July severe defoliation of scrub and red oak was reported in Menominee County. Subsequent aerial surveys showed large areas of oak to be heavily defoliated in the central and southeast portion of the county. The area of heavy defoliation mapped from the air amounted to 7,680 acres. Re-examination of the defoliated stands in August revealed a rapid re-foliation had occurred and affected stands were hardly discernible from those that were unaffected except for somewhat sparse appearance of the foliage.

Infested trees were mapped in the following parts of Menominee County:

Sections 11, 14, T24N, R15E where 600 acres of mostly good quality red oak were defoliated.

Sections 30, 31, 32, 33, T29N, R16E.

Sections 5, 6, 7, 18, 19, T28N, R16E.

Sections 1, 11, 12, 13, 14, 24, T28N, R15E where 7,080 acres of mostly poor scrub oak were defoliated.

Phenological Note:

June 19 - Some areas were almost completely defoliated. 95% of the larvae had pupated.

Large Aspen Tortrix - Archips conflictana (Walker)

Larvae could be found in most aspen stands in Ashland, Price, Rusk, Taylor and parts of Bayfield Counties, but defoliation was very light.

No defoliation was reported in the West Central Area where noticeable defoliation had occurred in Clark and Wood Counties in 1965.

Oak Webworm - Archips fervidanus (Clemens)

Colonies of the webworm were very numerous in parts of Burnett and Douglas Counties. Nests were primarily on sprouts of scrub oak along roadsides and were especially heavy in T42N, R13W and 14W in Burnett County, and in T43N, R13W, and T45N, and T46N, R11W in Douglas County.

Jack-Pine Budworm - Choristoneura pinus (Freeman)

Northwest Area - As predicted in 1966 budworm populations erupted in a majority of jack pine stands in the area. Moderate to complete defoliation occurred on about 80,000 acres (gross area) of jack-pine-type causing considerable top killing and tree mortality. Areas of severe defoliation were primarily in eastern Burnett County, northern Washburn County and parts of Douglas and Bayfield Counties. One small area of jack pine in Sawyer County (T42N, R9W) was severely defoliated in 1967. This area consisted mostly of plantations which had no known past history of budworm. Populations continued to decline in the Town of Sterling in Polk County and in western Burnett County where most of the mature and over-mature trees have been cut leaving apparently young vigorous stands. These will be observed closely in future years to see if this type of silvicultural operation is successful in reducing the frequency of budworm population buildups.

Pupal collections and egg mass surveys were made during July and August in all the jack pine type. Egg parasitism was very low in most areas and egg counts the highest of any year since these annual surveys have been conducted. Populations are expected to drop due to insufficient suitable feeding areas where stands have been severely defoliated. Populations are expected to be extremely high in stands which were near areas of heavy defoliation in 1967, but which were spared by the budworm then.

Northeast Area - Heavy infestations of jack-pine budworm occurred near Conover (Sections 16, 17, 22, 23, 28, 29, T42N, R10E) and Boulder Junction (Sections 20, 21, 28, 29, T42N, R7E) in Vilas County, covering 1,120 and 1,600 acres respectively. Tree mortality followed the first year of near complete defoliation of timber near Conover in 1966 and added mortality followed 1967 defoliation. Heavy defoliation occurred for the first year on jack-pine near Boulder Junction.

Over-mature stands, patches of over-mature trees in younger stands, and open-grown large-crowned trees were affected first in both localities. Tree mortality occurred in a plantation near Conover and egg counts indicated that populations would be high again in 1968.

Egg counts near Boulder Junction were about half those in the Conover area, but high populations are expected again in 1968.

Light to moderate infestations occurred in Marinette (Section 19, T32N, R19E), Menominee (Sections 10, 11, 12, T28N, R16E) and Oconto (Section 30, T30N, R18E) Counties.

West Central Area - Budworm populations increased in jack-pine stands throughout the area, but subsequent browning of trees was scattered. Heaviest populations and noticeable defoliation were found in Armenia Township in northeast Juneau County and Monroe Township in northwest Adams County. Egg surveys indicated that defoliation may be more severe in Adams, Jackson, Juneau and Wood County stands during 1968.

Phenological Notes:

May 29 - Jack pine shoots just beginning to expand. Staminate flowers beginning to form in Vilas County. No jack pine budworm larvae found on this date.

May 31 - First larvae observed in Polk and Burnett Counties. Jack pine leaders 4"-5"; staminate flowers showing yellow.

June 1 - First larvae observed in Bayfield and Douglas Counties. Leaders 3"-5", staminate flowers green and hard.

June 6 - Larvae still 2nd instar in Douglas County. Pollen ripe and plentiful in many areas. Leaders 5"-6". Oak flowering and leaves emerging.

June 12 - Jack pine shoots one-half inch to six inches in length Budworm larvae mostly in the late 2nd or early 3rd instars.

June 13 - Larvae 2nd and 3rd instars in Bayfield County. Pollen all shed.

June 15 - Larvae mostly 3rd instar with few 4th instars in Polk and southern Burnett County.

June 26 - Larvae range from 2nd to 4th instars with a majority in the 3rd instar in Douglas County.

June 29 - Larvae mostly 4th instar in Douglas County.

July 5 - First pupae observed in Douglas County.

July 10 - About 50% pupated in Washburn and eastern Burnett Counties.

July 13 - About 90% pupated in Washburn County - first moths observed.

July 14 - About 50% pupated in Bayfield County.

July 14 - Budworm about 60% in the 6th instar and 40% pupae.

July 17 - About 90% pupated in Douglas and Bayfield County.

July 17 - Observed first adults in Vilas County, 95% pupae.

July 24 - About 85% of adults emerged in Burnett and Washburn Counties.

July 25 - Adults numerous and copulating in Washburn County.

August 18 - Most budworm eggs hatched in Bayfield County but still an occasional 5th or 6th instar larva.

## Chemical Control - Jack-Pine Budworm

Several chemicals were tested in the field in the continuing search for a replacement for DDT. Tests were conducted during late June and early July in cooperation with the U. S. Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley, California as part of their Insecticide Evaluation Project; and the Chemagro Corporation, Kansas City, Missouri.

### Douglas County Insecticide Tests

### Selection of Test Areas

Early budworm larval counts were made to determine areas to be used for the tests. Counts of 20 second and third instar larvae per 30 jack pine shoots and flowers were considered sufficient to give adequate populations for testing. Most jack pine stands in southeastern Douglas County were found to have more than adequate populations. Many of the stands were near Solon Springs which had an excellent airfield in close proximity to the spray blocks. Three half-section blocks were selected in the Townships of Gordon and Highland with consideration given to: (1) nearness to airport, (2) ease in marking, (3) sufficient separation to avoid cross contamination, (4) sufficient distance from any lakes or streams, and (5) stand types for ease in evaluation.

## Evaluation

Courses and locations of plots for spray evaluation were marked in the blocks on June 26. Pre-spray larval counts were completed on June 28 and 29. Larval counts were made on four replicates of ten plots each within a block. Ten 15 inch twigs were clipped from at least 5 different trees at each plot and the budworm larvae and pupae on each twig were counted and recorded. Counts were made in the same manner three untreated control areas at least one mile away from the nearest spray block.

Post-spray checks were made five days after application in the same way and along the same courses as the pre-spray counts. Adjustment was made for natural mortality as determined from the control blocks. One series of plots in the Zectran block was found to have much higher counts than the other three replicates in the same block. Further investigation revealed that these were the southern most plots. Since the wind was from the south the evening of application, this difference was apparently due to drift.

Results of the test applications were as follows:

| Legal Description | Material | Rate of Application/Acre | % Chemical Control | Total Population Reduction |
|---|---|---|---|---|
| N½ Sec. 19, T44N R10W | Zectran | .15 lb. in 13 fl. oz. | 85.9 | 85.9 |
| | Omitting plots missed due to drift | | 90.6 | 90.6 |
| E½ Sec. 27, T44N R11W | Matacil | .15 lb. in 13 fl. oz. | 78.8 | 86.8 |
| S½ Sec. 7, T45N R10W | Dylox | 1 lb. in 1 qt. | 70.1 | 80.0 |

Both Zectran and Matacil gave sufficient control to warrant further testing for jack pine budworm control. The percent control indicated above for each chemical was reflected in the condition of the trees at the end of the growing season.

Following are notes on equipment, conditions, plot layouts, and comments on each test application completed.

# DOUGLAS COUNTY OPERATIONAL DATA - Matacil

Chemical name: 4-Dimethylamino-m-toyl methylcarbamate Producer: Chemagro Corp.

Batch No.: 12490 Amount Active Ingredient: 1.5 #/gal.

Size of Containers: 1 gal. Total on Hand: 34 Total No. Used: 34

Proposed Rate of Application: 13 fl. oz.

Actual Rate of Application: 12.06 fl. oz./A.

Calibration Material: Dowanol TPM, 20 gal.

Spray system flushed with 5 gal. Panasol before Matacil loaded and following Zectran application.

Size of Spray Block to be Treated: 320 Acres

Acreage Actually Treated: 346

Amount of Chemical Loaded: 34 gal. (4352 fl. oz.)

Amount of Chemical Applied: 4172 fl. oz.

Amount of Chemical Left in System After Spraying: 180 fl. oz.

Disposal of Excess: Buried

Airplane: Piper Pawnee, 1960, Model PA-25, 150 h.p.

Spray Tank: Stainless Steel Useful tank Capacity: 20 gal.

Pump: Wind-driven, Simplex, Size 1, Type cc.

Type Check Valve: Spraying Systems #4666

Screens: 100 mesh, Stainless Steel

Spray Tip Designation: Spraying Systems #8001

Number of Spray Tips Used: 11

Position of Nozzle Locations Used Indicated by Underlined Numbers Below:

| Left Wing: | | Right Wing: |
|---|---|---|
| $\underline{11}$-10-$\underline{9}$-8-$\underline{7}$-6-$\underline{5}$-4-$\underline{3}$-2-$\underline{1}$ | Fuselage | 1-2-$\underline{3}$-4-$\underline{5}$-6-$\underline{7}$-8-$\underline{9}$-10-$\underline{11}$ |

Flow Rate: 1.16 gpm (148.48 fl. oz./min.)

Effective Swath Width: 66'

Pressure in System During Spraying: 40 lbs. Steady: Yes X No

Airspeed: 90 mph indicated

Airport Location: Solon Springs, Wisconsin

Legal Description of Treated Blocks: E½ Section 27 T44N R11W

Date of Application: June 30, 1967

Time of Spray Application: Start: 6:15 p.m. Finish: 8:15 p.m.

Number of Swaths Flown: 44.5 Uniform Length: Yes____ No_X_ (See plot diagram)

Total Chains Flown: 3,480

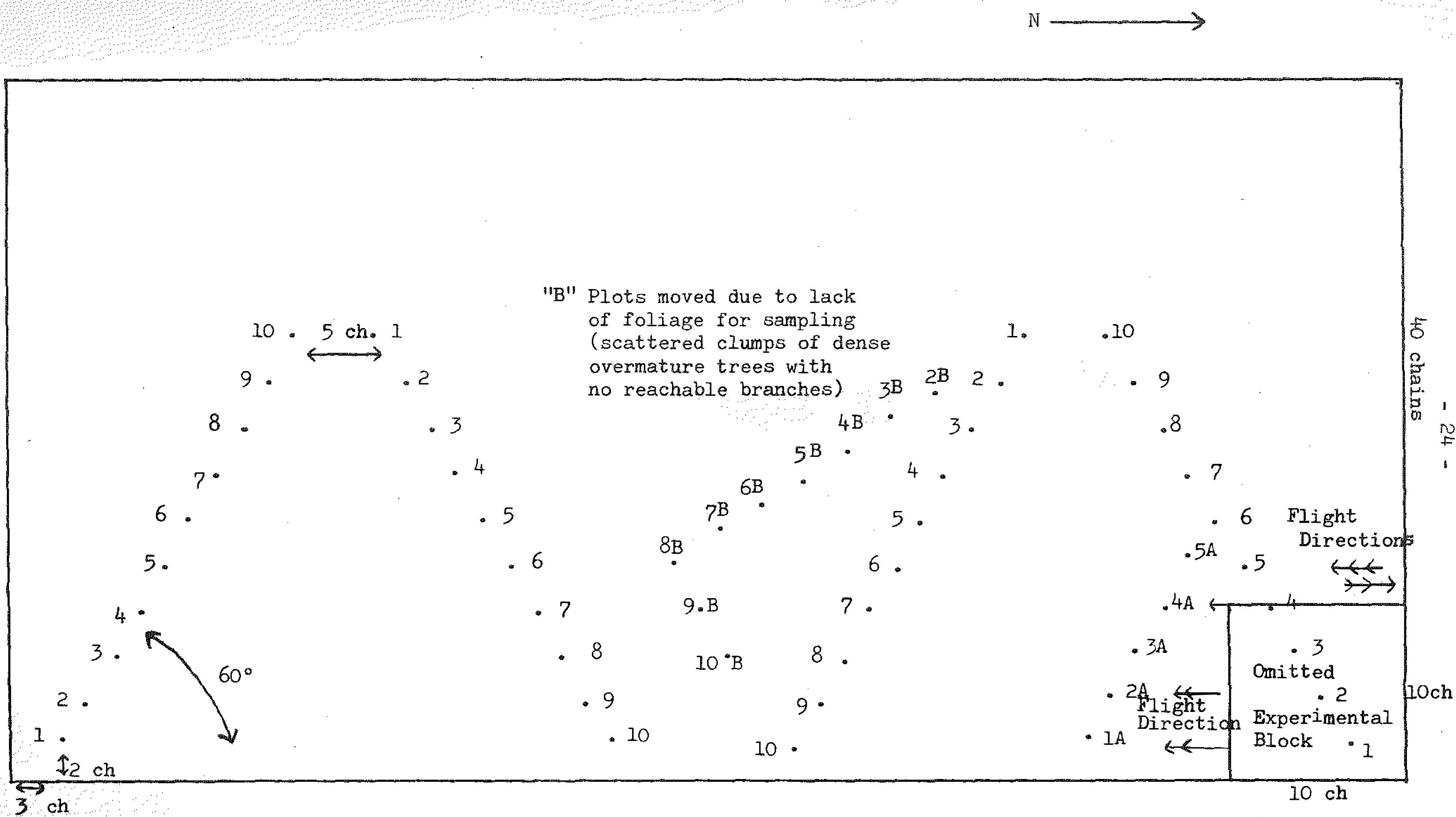
Direction of Flight: N-S

Wind or Air Movement at Time of Spraying: Calm

Temperature: 76° F. at airport

Precipitation: Light rain at airport. Thundershower between 7:30 and 8:00 p.m. C.D.S.T. passed to south of spray block. Water container in block was dry after passage of thundershower.

# MATACIL PLOT LAYOUT


N
40 chains
10 ch
10ch
3 ch
2 ch
5 ch.
60°
1
2
3
4
5
6
7
8
9
10
1A
2A
3A
4A
5A
2B
3B
4B
5B
6B
7B
8B
9.B
10 B
Flight Direction
Flight Directions
Omitted Experimental Block

"B" Plots moved due to lack of foliage for sampling (scattered clumps of dense overmature trees with no reachable branches)

80 chains
1 chain = 66 ft.

"A" Plots moved due to Experimental Block

MATACIL - .15 lb. in 13 oz.

Totals on Treatment Blocks

| | | |
|---|---|---|
| Course 1 | 389 | larvae |
| " 2 | 461 | " |
| " 3 | 434 | " |
| " 4 | 451 | " |

4)1735 pre-spray larvae

= 4.3375 larvae per 15" branch

Control block:

Larvae/twig

| | |
|---|---|
| pre-spray | 6.82 |
| post-spray | 6.27 |
| | .55 drop (natural) |

$\frac{.55}{6.82}$ = 8% drop

4.3375 x .08 = .3470 natural drop

4.3375 pre-spray larvae/15" branch
- .3470 natural drop
3.9905
- .5725 post-spray larvae/15" branch
3.4180 reduction due to chemical

post-spray counts on treated blocks

| | |
|---|---|
| 63 | Course 1 |
| 45 | " 2 |
| 64 | " 3 |
| 57 | " 4 |

4)229

.5725 larvae per 15" branch

$\frac{3.4180}{4.3375}$ = 78.8% reduction due to chemical

4.3375
- .5725
3.7650 Total population reduction

$\frac{3.7650}{4.3375}$ = 86.8% total population reduction

## DOUGLAS COUNTY OPERATIONAL DATA - Zectran

Chemical name: 4 - dimethylamino - 3.5 - xylyl methylcarbamate

Producer: Dow Chemical Amount Active Ingredient: 1.5#/gal.

Size of Containers: 5 gal. Total on Hand: 5 Total No. Used: 5

Proposed Rate of Application: 13 fl. oz.

Actual Rate of Application: 12.16 fl. oz/A.

Calibration Material: Dowanol TPM, 20 gal.

Size of Spray Block to be Treated: 250 Acres

Acreage Actually Treated: 246 Acres

Amount of Chemical Loaded: 25 gal. (3200 fl. oz.)

Amount of Chemical Applied: 2992 fl. oz.

Amount of Chemical Left in System After Spraying: 208 fl. oz.

Disposal of Excess: Buried

Airplane: Piper Pawnee, 1960, Model PA-25, 150 h.p.

Spray Tank: Stainless Steel Useful tank Capacity: 20 gal.

Pump: Wind-driven, Simplex, Size 1, Type cc.

Type Check Valve: Spraying Systems #4666

Screens: 100 mesh, Stainless Steel

Spray Tip Designation: Spraying Systems #8001

Number of Spray Tips Used: 11

Position of Nozzle Locations Used Indicated by Underlined Numbers Below:

Left Wing: Right Wing:

$\underline{11}$-10-$\underline{9}$-8-$\underline{7}$-6-$\underline{5}$-4-$\underline{3}$-2-$\underline{1}$ **Fuselage** 1-2-$\underline{3}$-4-$\underline{5}$-6-$\underline{7}$-8-$\underline{9}$-10-$\underline{11}$

Flow Rate: 1.16 gpm (148.48 fl. oz./min.)

Effective Swath Width: 66'

Pressure in System During Spraying: 40 lbs. Steady: Yes X No ____

Airspeed: 90 mph indicated

Airport Location: Solon Springs, Wisconsin

Legal Description of Treated Blocks: N½ Section 19 T44N R10W

Date of Application: June 29, 1967

Time of Spray Application: Start 8:20 p.m. Finish: 9:45 p.m.

Number of Swaths Flown: 30.75 Uniform Length: Yes__X__ No_____

Number of 66 foot Chains per Swath: 80 Total Chains Flown: 2,460

Direction of Flight: E-W

Wind or Air Movement at Time of Spraying:

Direction: Slight drift from SW Velocity: Near calm at tree top height, but pilot reported encountering strong airflow in making turns at ends of swaths.

Temperature: 71°F. at airport

ZECTRAN - .15 lb. in 13 oz.

Pre-Spray Counts 806
524
758
635
4)2723

6.8075 larvae per 15" branch
- .9575
5.8500 reduction due to chemical

$\frac{5.85}{6.8075}$ = 85.93% reduction due to chemical

Control block:

pre-spray 738
post-spray 738
0 drop

Post-spray checks 62
70
60
191
4) 383

.9575 per 15" branch

Leaving out Course missed due to drift

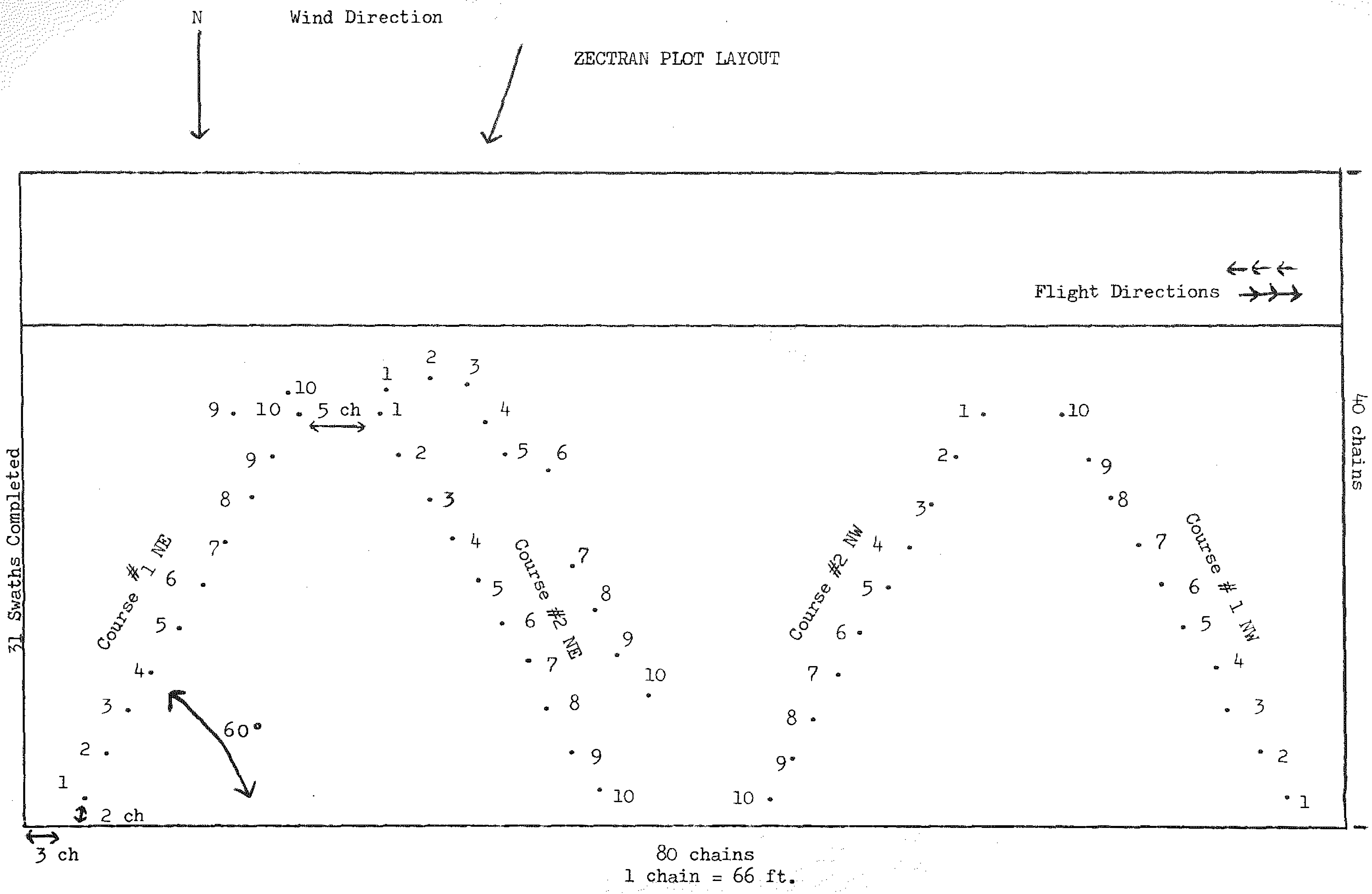
6.8075 larvae per 15" branch
-.6400
6.1675 reduction

$\frac{6.1675}{6.8075}$ = 90.6% reduction

62
70
60
3)192

.64 larvae per 15" branch

## ZECTRAN PLOT LAYOUT


N
Wind Direction
Flight Directions
40 chains
31 Swaths Completed
Course #1 NE
Course #2 NE
Course #2 NW
Course # 1 NW
5 ch
2 ch
3 ch
60°
80 chains
1 chain = 66 ft.

Plots moved due to lack of
foliage for sampling (Scattered
clumps of dense overmature trees
with no reachable branches)

## COMMENTS ON ZECTRAN APPLICATION:

The plot layout was the same as that used for Dylox and Matacil.

Representatives of the following insect groups, apparently killed by the spray, were collected from the ground in the Zectran block 18 hours after treatment:

Various wasps - Ichneumonid and others
Bald-faced hornet
Tussock moth - pine and other
Tortricids
Nymphalis genus
Asilids
Pentatomids
Phyllophaga sp. and related genera
Tipulids
Buprestids
Cerambycids
A jumping spider

During calibration flights in mid-afternoon temperature reached 79°F. in the shade and air movement was light and variable between west and north-northwest. Light, broken cloud cover in the afternoon cleared by evening.

Screens and nozzles were cleaned with acetone during the calibration process.

Effective swath width was checked at the airport by flying at right angles over a line of cards. Visible deposits on the cards indicated that the 66 foot width would be satisfactory with the plane working at 50 feet above the canopy.

The day following Zectran application many dead budworm larvae were found up to 660 feet north of the spray block.

Improved means of evaluating air conditions over spray blocks are needed. Perhaps use of smoke plumes or tracking a helium filled free balloon would provide adequate information to help determine what will happen to spray that is applied, and permit adequate allowances for drift that might occur.

## DOUGLAS COUNTY OPERATIONAL DATA - Dylox

Chemical name: Dimethyl(2,2,2 - trichloro - 1 - hydroxyethyl phosphonate

Producer: Chemagro Corp. Batch No.: 12047

Amount Active Ingredient: 4#/gal. Formula No.: 1051

Size of Containers: 5 gal. Total on Hand: 16 Total No. Used: 16

Proposed Rate of Application: 32 fl. oz.

Actual Rate of Application: 29.73 fl. oz./A.

Calibration Material: Dowanol TPM, 20 gal.

Size of Spray Block to be Treated: 320 Acres

Acreage Actually Treated: 338 Acres

Amount of Chemical Loaded: 80 gal. (10,240 fl. oz.)

Amount of Chemical Applied: 10,048 fl. oz.

Amount of Chemical Left in System After Spraying: 192 fl. oz.

Disposal of Excess: Buried

Airplane: Piper Pawnee, 1960, Model PA-25, 150 h.p.

Spray Tank: Stainless Steel Useful tank Capacity: 20 gal.

Pump: Wind-driven, Simplex, Size 1, Type cc.

Type Check Valve: Spraying Systems #4666

Screens: 100 mesh, Stainless Steel

Spray Tip Designation: Spraying Systems #80015

Number of Spray Tips Used: 22

Position of Nozzle Locations Used Indicated by Underlined Numbers Below:

Left Wing: Right Wing:

11-10-9-8-7-6-5-4-3-2-1 Fuselage 1-2-3-4-5-6-7-8-9-10-11

Flow Rate: 3 gpm

Effective Swath Width: 66'

Pressure in System During Spraying: 40 lbs. Steady: Yes X No ____

Airspeed: 90 mph indicated

Airport Location: Solon Springs, Wisconsin

Legal Description of Treated Blocks: S½ Section 7 T45N R10W

Date of Application: July 1, 1967

Time of Spray Application: Start 5:25 a.m. Finish 8:20 a.m. C.D.S.T.

Number of Swaths Flown: 42.25 Uniform Length: Yes X No____

Number of 66 feet Chains per Swath: 80 Total Chains Flown: 3,380

Direction of Flight: E-W

Wind or Air Movement at Time of Spraying: Calm at start. By 7:00 a.m. slight drift from northwest. By 8:30 a.m. air was moving up to 4 or 5 miles per hour.

Temperature: 57° F. in shade at start, 67° F. in shade at finish.

**DYLOX** - 1 pound in 1 qt.

Pre-Spray Counts

Course #1 620 larvae
# 2 535 "
# 3 557 "
# 4 601 "
4)2313 pre-spray on treatment blocks

5.7825 larvae per 15" branch

5.7825 x .103 = .5956 natural drop

5.7825
- .5956 natural drop
5.1869
-1.1325 post-spray larvae/15" branch
4.0544 reduction due to chemical

$\frac{4.0544}{5.7825}$ = 70% reduction due to chemical

5.7825
-1.1325
4.6500 = total population reduction

Control block:

Larvae/15" twig:

pre-spray 11.65
post-spray 10.45
1.20 drop (natural)

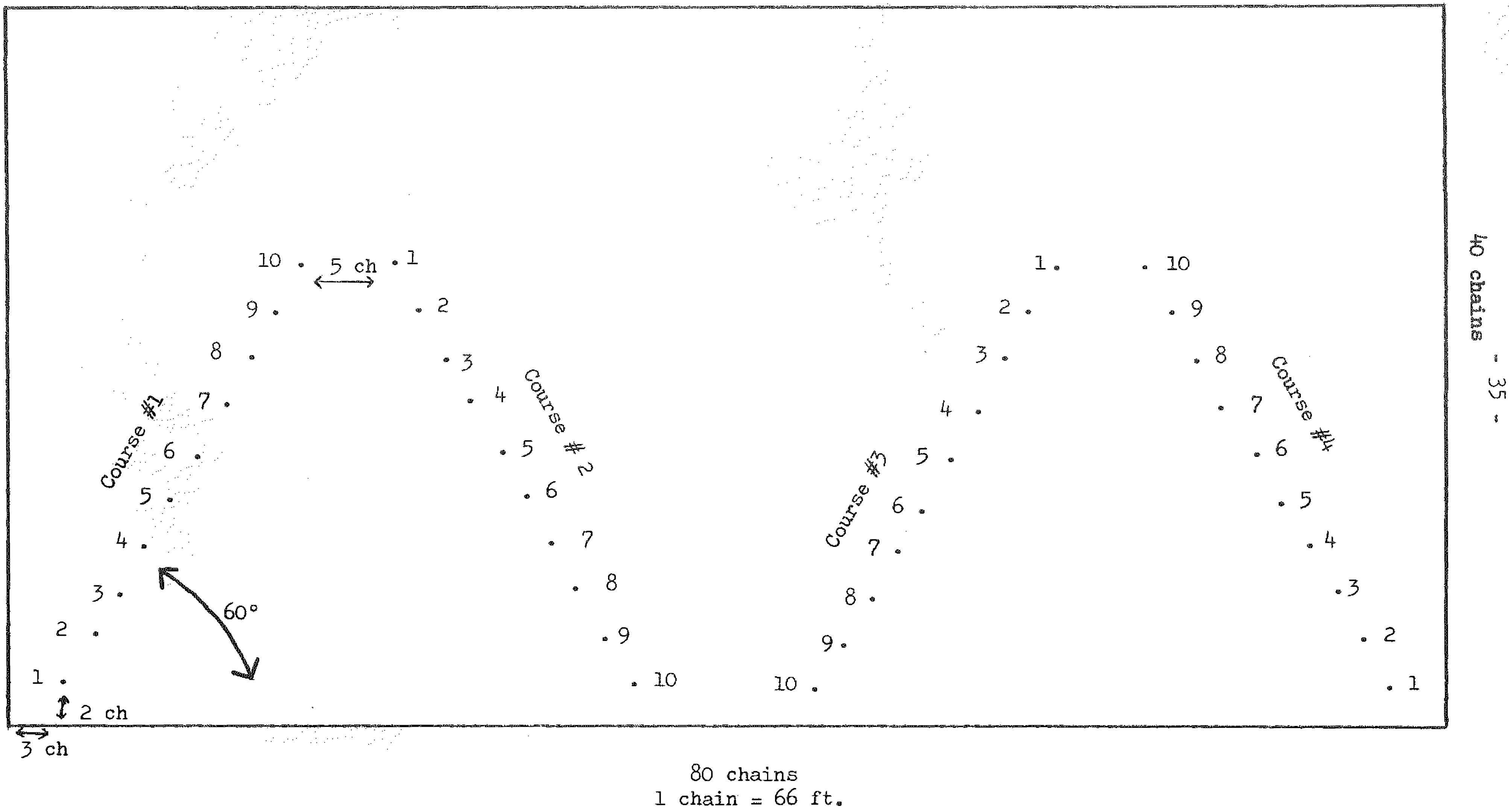
$\frac{1.20}{11.65}$ = 10.3% drop

Post-spray counts on treated blocks
78 Course #1
137 " #2
134 " #3
104 " #4
4)453

1.1325 larvae per 15" branch

$\frac{4.65}{5.7825}$ = 80% total population reduction

# DYLOX PLOT LAYOUT


Course #1
1
2
3
4
5
6
7
8
9
10
5 ch
Course # 2
1
2
3
4
5
6
7
8
9
10
Course #3
1
2
3
4
5
6
7
8
9
10
Course #4
1
2
3
4
5
6
7
8
9
10
60°
2 ch
3 ch
40 chains
80 chains
1 chain = 66 ft.

## VILAS COUNTY INSECTICIDE APPLICATIONS - DYLOX AND MALATHION

### INTRODUCTION

The jack-pine budworm was in outbreak for the second year on a 1,600 acre area near Conover, Wisconsin. Infested timber in adjoining parts of five sections consisted of natural and planted trees ranging in age from 45-years-plus downward. Top-killing and tree mortality were apparent over 600 acres after the 1966 defoliation. (See map page 37).

### OBJECTIVE

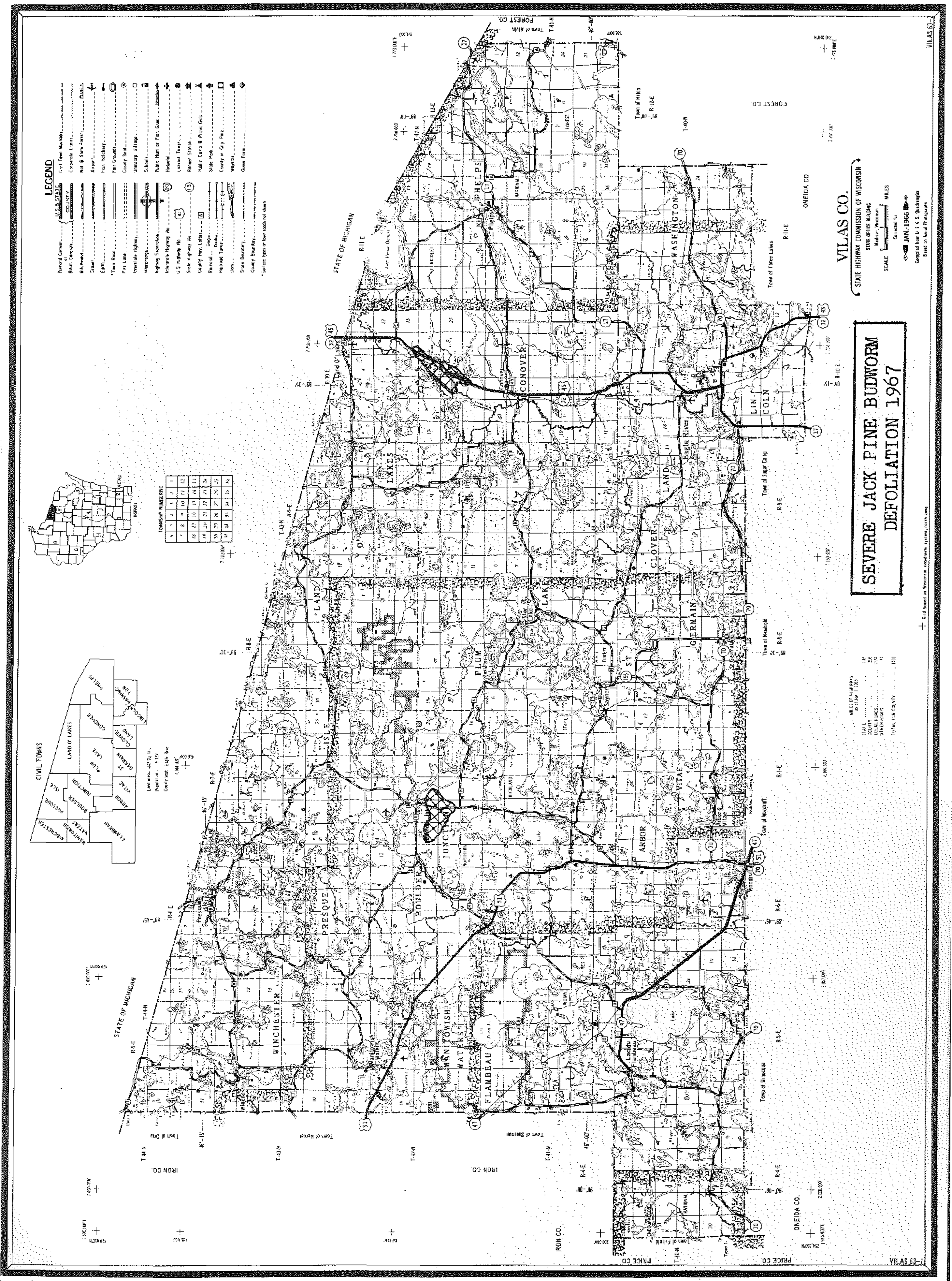
Aerial application of 8 fluid ounces of Malathion 95% LV concentrate in Bayfield County in 1966 had not provided adequate control of the budworm, and it was felt that perhaps application at a higher rate, and/or volume per acre would provide better results.

Dylox 4 lb. ULV was tested in Douglas County on July 1, 1967 at a rate of one pound in 32 fluid ounces of spray per acre. Initial effects of the treatment indicated that perhaps the same Dylox should be tested at 1/2 the rate and volume in Vilas County if the opportunity was available.

### APPLICATION

The insecticides were applied with a Piper Pawnee equipped for low volume concentrate spraying. Sixteen Spraying Systems nozzles with No. 80015 spray tips were spaced and adjusted on the boom to provide the best coverage with the smallest possible spray particles. The plane was flown at 90 m.p.h. about 50 feet above the canopy of the trees and a 66-foot wide effective swath was used. A pressure of 40 pounds was maintained in the spray system by a wind-driven pump.

Dylox was applied the evening of July 5. The air was near calm with a very slight drift from the northwest when spraying started at 8:25 p.m. The temperature was 68°F.



SEVERE JACK PINE BUDWORM DEFOLIATION 1967

VILAS CO.
STATE HIGHWAY COMMISSION OF WISCONSIN
JAN. 1966
LEGEND
CIVIL TOWNS
TOWNSHIP NUMBERING
STATE OF MICHIGAN
FOREST CO.
ONEIDA CO.
IRON CO.
PRICE CO.
PHELPS
WASHINGTON
CONOVER
LINCOLN
LAND O' LAKES
CLOVER
LAND
ST. GERMAIN
PLUM LAKE
PRESQUE ISLE
BOULDER JUNCTION
ARBOR VITAE
WINCHESTER
MANITOWISH WATERS
FLAMBEAU
Eagle River
VILAS 63-7

Prior to application of Malathion the spray system was flushed with HAN solvent. Air temperature near the ground at the spray block was 48°F. when the Malathion application started at 5:40 a.m. on July 6 and 50°F. when it was finished at 6:30 a.m. The air was calm during the spraying period.

## EVALUATION

The relatively small infestation area did not permit wide spacing of spray and check blocks or use of large blocks. Ten evaluation plots were set up along a single transect in each spray block and a check block. Budworm larvae were counted on ten 15-inch samples of needle-bearing-twigs collected from no less than 5 trees at each plot.

Pre-spray larval counts were made the day prior to treatment, and post-spray counts five days later.

## RESULTS

| Spray Block No. | Acres Treated | Insecticide | Rate of Application/Acre Proposed | Actual | Population Reduction Chemical | Natural | Total |
|---|---|---|---|---|---|---|---|
| 1 | 40 | Malathion | 16 fl. oz. | 14.2 fl. oz. | 67.3% | 3.5% | 70.8% |
| 2 | 60 | Dylox | 16 fl. oz. | 18.2 fl. oz. | 93 % | 3.5% | 96.5% |
| 3 | 64.5 | Malathion | 16 fl. oz. | 15.9 | 61.4% | 3.5% | 64.9% |

## DISCUSSION

Initial pre-spray sampling was done on June 30 when larvae were mostly in the third and fourth instars, but involvement in tests in Douglas County prevented treatment during the next 6 days. Meanwhile, between June 30 and July 5 when pre-spray counts were repeated, hot weather accelerated larval feeding and development and a 50% natural reduction of the larval population occurred. Larvae at the time of spraying were mostly in the 5th instar, some in the sixth, and occasional moths were noted.

Time did not permit a complete pre-spray recount of the treatment and check blocks the day before the application of chemicals with the result that only 5 plots were checked on the Dylox block, and counts were made on only one check block which was used in evaluating each of the treatment blocks, since it was in close proximity to all of them. Pre- and post-spray counts are listed below for each block.

| Date of Counts | Block No. | Chemical | Total Budworm Pre-Spray | Total Budworm Post-Spray |
|---|---|---|---|---|
| 7- 5-67 | 1 | Malathion (10 plots) | 710 | - |
| 7-11-67 | 1 | " " " | - | 207 |
| 7- 5-67 | 2 | Dylox (5 plots) | 289 | - |
| 7-10-67 | 2 | " " " | - | 10 |
| 7- 5-67 | 3 | Malathion (10 plots) | 937 | - |
| 7-10-67 | 3 | " " " | - | 329 |
| 7- 5-67 | Control | (10 plots) | 449 | - |
| 7-10-67 | Control | (10 plots) | - | 433 |

While the Dylox data may have limited value because of the problems encountered, the condition of the stands following treatment clearly reflect the degree of control indicated.

The post-treatment condition of the block treated with Dylox was good, while those treated with Malathion, and the check area, were poor. Block No. 3, treated with Malathion, had very large trees on it and the observer felt that penetration of the canopy by the insecticide was not adequate. The upper six feet of the crowns were covered with silk strands from dropping larvae, but larvae on the mid and lower portions of the crowns, and on understory trees were little disturbed.

The difference in temperatures and time of day during which applications were made may have accounted in part for the difference in results between the two materials applied.

Calculations used to arrive at the percent control follow.

VILAS COUNTY TEST

Block 1 Malathion Actual Volume Applied: 14.2 fl. oz./acre

| Spray Block | | Control Block | |
|---|---|---|---|
| Pre-spray | 710 total larvae | Pre-spray | 449 larvae |
| Post-spray | 207 " " | Post-spray | 433 " |
| | -503 larvae | | -16 larvae |

$\frac{503}{710}$ = 70.8% total drop $\frac{16}{449}$ = 3.5% normal drop

70.8% - 3.5% ND = 67.3% - Drop due to chemical

Block 2 Dylox Actual Volume Applied: 18.2 fl. oz./acre

| Spray Block | | Control Block | |
|---|---|---|---|
| Pre-spray | 289 total larvae | Pre-spray | 449 larvae |
| Post-spray | 10 " " | Post-spray | 433 " |
| | -279 larvae | | -16 larvae |

$\frac{279}{289}$ = 96.5% total drop $\frac{16}{449}$ = 3.5% normal drop

96.5% - 3.5% ND = 93% Drop due to chemical

Block 3 Malathion Actual Volume Applied: 15.9 fl. oz./acre

| Spray Block | | Control Block | |
|---|---|---|---|
| Pre-spray | 937 total larvae | Pre-spray | 449 larvae |
| Post-spray | 329 " " | Post-spray | 433 " |
| | -608 larvae | | -16 larvae |

$\frac{608}{937}$ = 64.9% total drop $\frac{16}{449}$ = 3.5% normal drop

64.9% - 3.5% ND = 61.4% Drop due to chemical

Notes on Side-Effects - Vilas County Budworm Control Tests.

Representatives of the following orders of arthropods were picked from the ground during a fifteen minute period 5 hours after a jack-pine stand was treated with Malathion at about 16 fl. oz. l.v.c./acre. Some specimens still moved slightly when collected.

Specimens have been submitted to University of Wisconsin taxonomists for more specific identification.

- Coleoptera
  - Coccinellids
  - Elaterids (2 sp.)
  - Cantharid - like beetle
  - Carabids (3 sp.)
  - Weevil
  - Unidentified (1)

- Diptera
  - Tachinids (2 sp.)
  - Calliphorids
  - Tabanid (Deer Fly)
  - Unidentified (1)

- Hymenoptera
  - Ichneumonids (2 sp.)
  - Bald-faced hornet
  - Sawfly larvae
  - Unidentified wasps (2 sp.)
  - Ants (2 sp.)

- Lepidoptera
  - Budworm larvae and moths

- Orthoptera
  - Unidentified grasshopper nymph

- Arachnids
  - Phalangid
  - Unidentified spider

Fourteen hours after application of Dylox at 16 fl. oz. of 4#/gal. concentrate per acre, the following arthropods were collected along a trail through the spray block:

- Coleoptera
  - Phyllophoza sp.
  - Dichelonyx sp.
  - Lady beetles - 2 sp.
  - Elaterids
  - Carabids - 2 sp.
  - A weevil

- Hymenoptera
  - Ants - 2 sp.
  - Ichneumonids

- Mecoptera
  - Panorpa sp.

- Diptera
  - Tabanids
  - Tachinids
  - Tipulids
  - Syrphids

- Lepidoptera
  - Budworm larvae - several instars
  - Geometrid larvae

- Spiders

### Pine Tussock Moth - *Dasychira plagiata* (Walker)

Predicted tussock moth populations failed to materialize in the Northwest Area in 1967, due to winter and early spring larval mortality, and little defoliation occurred. However, egg counts made in August indicated that populations increased in several localities, and eggs were generally more common throughout the jack pine type than they were in 1966. Eggs were most numerous in Sections 21, 22 and 27, T44N, R11W; in Section 3, T42N, R13W; and in Sections 28, 33, and 34, T43N, R13W.

Defoliation in 1968 is not expected to be serious, but light to moderate defoliation is anticipated on about 20,000 acres (gross area) in Douglas County. A combination of the tussock moth and budworm in the same stands could result in severe defoliation.

Phenological Notes:

April 26 - Larvae started emerging from hibernation.
April 28 - First larval feeding noted. Temperature 55°F.
May 23 - Larvae still mostly in the 2nd instar. Very little evidence of feeding.
June 16 - Larvae mostly in 3rd instar.
June 28 - Larvae in 3rd and 4th instars.
July 26 - Some larvae starting to pupate.
July 31 - About 95% of larvae had pupated. A few eggs were found.
August 7 - Moths had emerged from a majority of the pupae.
August 14 - Egg laying nearly completed. A few eggs had started to hatch.
August 28 - Most eggs had hatched.
August 30 - Some larvae started to hibernate.
September 18 - All larvae apparently in hibernation. Little evidence of fall feeding-injury.

Zimmerman Pine Moth - Dioryctria zimmermani (Grote)

Brown new shoots, killed by the insect, were evident on red pine in nursery windbreaks at Boscobel, and on plantation trees in the vicinity of the nursery (Grant County) and elsewhere along the Wisconsin River Valley. While shoot injury may have affected the salability of Christmas trees, it did little apparent damage.

A few reports of infested Scotch pine Christmas trees were received from Jackson and Trempealeau Counties. Scotch pine in Marquette County was also heavily infested; but trees tolerated attacks well.

Jack-Pine Shoot Borer - Eucosma sonomana Kearfott

Damage terminals were found in most Scotch pine Christmas tree and jack pine stands in the West Central Area. Heavily infested Scotch pine in Marquette County appeared to tolerate attacks with little serious damage.

Saddled Prominent - Heterocampa guttivitta (Walker)

Defoliation was severe to complete on most of the maples, beech, and ironwood on Rock Island (Door County, T34N, R30E, including parts of Sections 14, 15, 22, 23, 26 and 27) on September 6. The park ranger had observed the last active larvae approximately 3 weeks previously. Most trees, of the species indicated, were defoliated in a ravine that extended most of the length of the island. Basswood, white birch, and oaks appeared to be much less-preferred hosts.

Mummified larvae were numerous on tree trunks in an area adjacent to the northeast corner of the estate on the island and pupae were abundant in the leaf litter. Few larvae or pupae were observed at the north end of the island near the lighthouse although defoliation was severe in the area. Defoliation was least severe at the south end of the island.

Refoliation on maples varied from none on some trees to leaves about 3" in diameter, and also varied from branch to branch on the same tree.

The infestation appeared to be in its third year at the north end of the island and in its second year toward the south end. The park ranger recalled previous defoliation of similar severity having occurred 10 to 12 years ago on the island.

Eastern Tent Caterpillar - Malacosoma americanum (Fabricius)

A few tents were noted in southern Burnett County and very few were observed in other forested areas.

Forest Tent Caterpillar - Malacosoma disstria (Hubner)

One colony of larvae was reported in Douglas County, Section 31, T43N, R10W. No egg masses were found in winter egg mass surveys conducted in the northern counties.

ORTHOPTERA

Post Oak Locust - Dendrotettix quercus (Packard)

An infestation in Marinette County was located within the same area as a walkingstick infestation in the Town of Stephenson. Populations varied from light to moderate as determined by time counts, and distribution appeared to be related to availability of grassy oviposition sites within scrub oak stands. The insect appears to have a two year life cycle, similar to that of the walkingstick, and has been most numerous in Marinette County during odd-numbered years since 1959.

Most stands infested by the "grasshopper" were also infested by the walkingstick making it difficult to evaluate the amount of damage attributable to each insect. In light to moderately infested stands, where both insects are active, it is estimated that the "grasshopper" consumes about 30% of the foliage eaten.

Little defoliation of oak was noted in the West Central Area, although recently-hatched nymphs were present in large numbers at scattered locations near Millston (Jackson County) on June 6, and the insects were readily found during the summer.

Phenological Notes:

June 7 - Emergence of newly-hatched nymphs reached a peak in Marinette County.

July 12 - Most nymphs were in the 3d instar.

August 9 - Most "grasshoppers" were mature and mating pairs were noted.

Walkingstick - Diapheromera femorata (Say)

An aerial survey of Marinette County in late August indicated a further decline in severity of odd-year infestations which have been centered mostly in the Town of Stephenson. Records indicate a peak was reached in 1961 when 36,000 acres of oak timber were heavily defoliated, and the acreage of severe to complete defoliation in odd-numbered years since has been declining. Total defoliation occurred on 500 acres this year, and the acreage of moderate defoliation increased. The post oak locust, Dendrotettix quercus (Packard), active in the same area as the walkingstick, may have contributed to the increase in acreage of moderate defoliation.

Approximately 200 acres of heavy defoliation occurred in Menominee County, involving a few small stands or individual trees within an area of previous heavy defoliation.

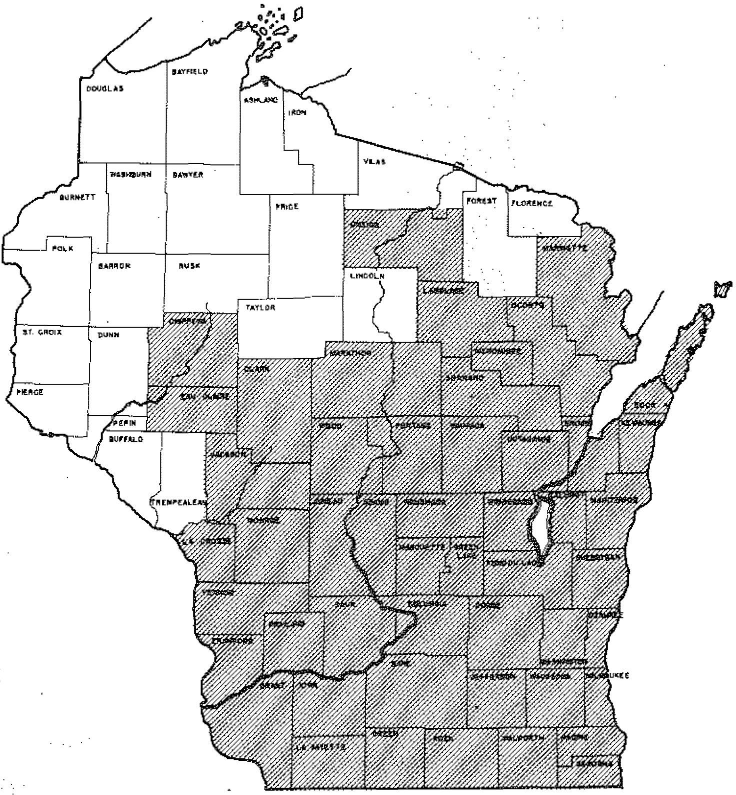
Walkingsticks were rarely observed during the summer in the West Central Area and defoliation in the Eau Claire County forest was very light. Three mature walkingsticks were found in the forest on October 12.

# MAJOR FOREST DISEASES

## WILTS AND DIEBACKS

### Dutch Elm Disease - Ceratocystis ulmi (Buisman) Moreau

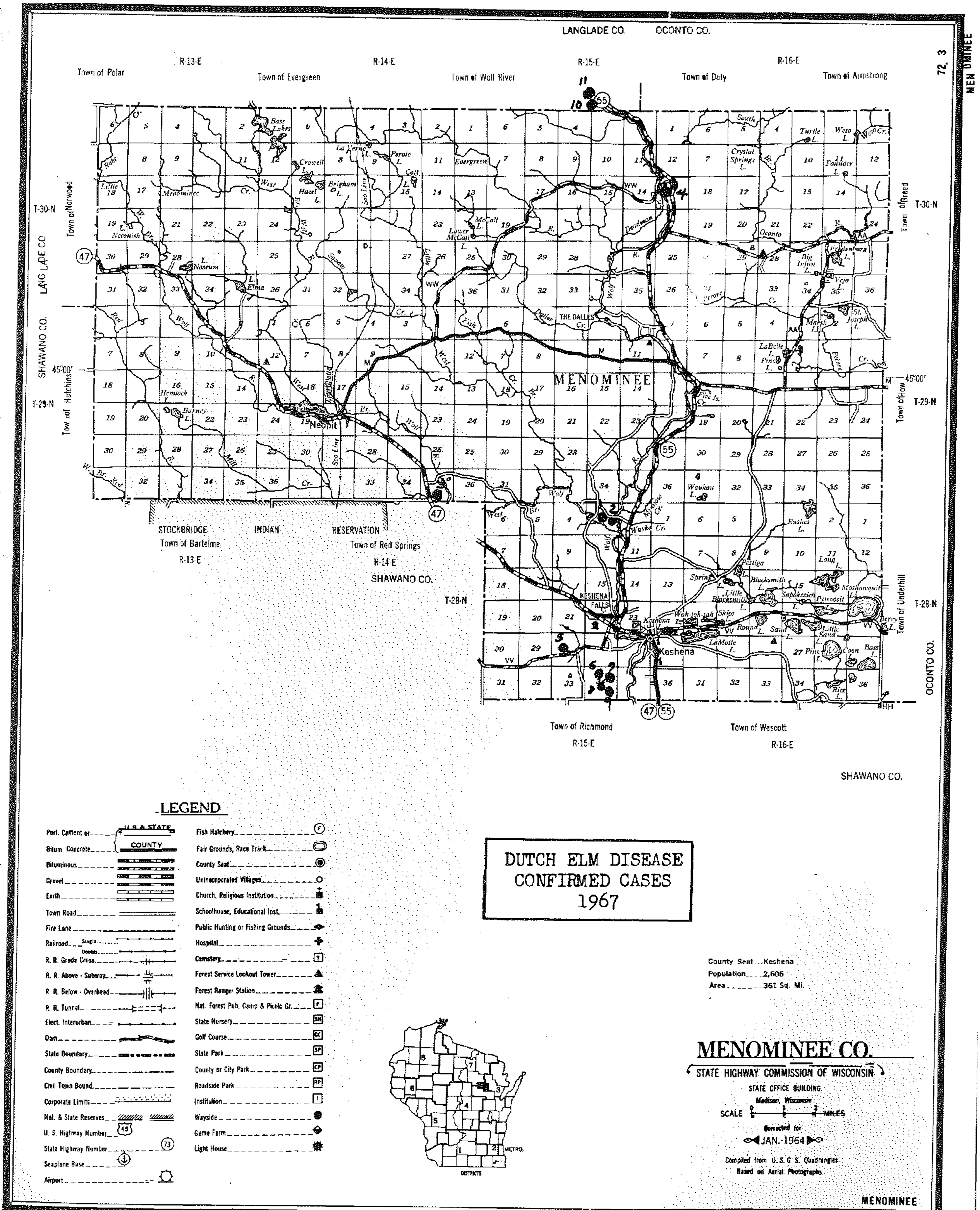
Dutch elm disease has been reported in 50 of Wisconsin's 72 counties (see map below). New counties reported in 1967 were Door, Jackson, Juneau, Langlade, Menominee and Oneida.


DOUGLAS
BAYFIELD
ASHLAND
IRON
VILAS
WASHBURN
SAWYER
BURNETT
PRICE
FOREST
FLORENCE
POLK
BARRON
RUSK
LINCOLN
TAYLOR
ST. CROIX
DUNN
PIERCE
PEPIN
BUFFALO
TREMPEALEAU
EAU CLAIRE
MARATHON
CLARK
WOOD
PORTAGE
LANGLADE
OCONTO
MENOMINEE
SHAWANO
DOOR
KEWAUNEE
MANITOWOC
SHEBOYGAN
FOND DU LAC
MARQUETTE
GREEN LAKE
COLUMBIA
SAUK
LA CROSSE
JACKSON
GRANT
IOWA
MILWAUKEE
LA FAYETTE
GREEN
ROCK
WALWORTH

Known Distribution of
Dutch Elm Disease
1967

Aerial and ground surveys revealed that 9 American elms were infected with Dutch elm disease in Menominee County in 1967 (see map on page 47). Elm comprises 7.6 percent of the total volume of merchantable timber on the 132,000 acre Menominee County Forest. The elm volume is estimated as follows:

| Species | Merchantable Volume (Board Feet) | (Cords) | Total Volume (Percent) |
|---|---|---|---|
| American Elm | 77,949,000 | 46,491 | 5.1 |
| Rock Elm | 37,831,000 | 11,944 | 2.5 |
| Total | 115,780,000 | 58,435 | 7.6 |


LANGLADE CO.
OCONTO CO.
R-13-E
R-14-E
R-15-E
R-16-E
Town of Polar
Town of Evergreen
Town of Wolf River
Town of Doty
Town of Armstrong
T-30-N
T-29-N
T-28-N
Town of Norwood
Town of Hutchins
LANGLADE CO.
SHAWANO CO.
Town of Breed
Town of How
Town of Underhill
OCONTO CO.
45°00'
MENOMINEE
Neopit
Keshena
KESHENA FALLS
THE DALLES
STOCKBRIDGE INDIAN RESERVATION
Town of Bartelme
Town of Red Springs
SHAWANO CO.
Town of Richmond
Town of Wescott
SHAWANO CO.
11
10
2
4
5
6
LEGEND
Port. Cement or Bitum. Concrete
U.S. & STATE
COUNTY
Bituminous
Gravel
Earth
Town Road
Fire Lane
Railroad Single Double
R. R. Grade Cross.
R. R. Above - Subway
R. R. Below - Overhead
R. R. Tunnel
Elect. Interurban
Dam
State Boundary
County Boundary
Civil Town Bound.
Corporate Limits
Nat. & State Reserves
U. S. Highway Number
State Highway Number
Seaplane Base
Airport
Fish Hatchery
Fair Grounds, Race Track
County Seat
Unincorporated Villages
Church, Religious Institution
Schoolhouse, Educational Inst.
Public Hunting or Fishing Grounds
Hospital
Cemetery
Forest Service Lookout Tower
Forest Ranger Station
Nat. Forest Pub. Camp & Picnic Gr.
State Nursery
Golf Course
State Park
County or City Park
Roadside Park
Institution
Wayside
Game Farm
Light House
County Seat...Keshena
Population....2,606
Area.......361 Sq. Mi.
DISTRICTS
MENOMINEE CO.
STATE HIGHWAY COMMISSION OF WISCONSIN
STATE OFFICE BUILDING
Madison, Wisconsin
SCALE MILES
Corrected for JAN. 1964
Compiled from U. S. G. S. Quadrangles
Based on Aerial Photographs
MENOMINEE

DUTCH ELM DISEASE
CONFIRMED CASES
1967

Slippery elm (Ulmus rubra) was grouped with the American elm (Ulmus americana) because it was difficult to distinguish between the two species. The merchantable volume of slippery elm could not be determined exactly, but it was estimated to comprise 3 percent of the volume listed under American elm.

Because of the vast resource of elm in Menominee County special recommendations were prepared for the Menominee County Forest:

## Dutch Elm Disease Recommendations for Menominee County

The following statement and recommendations regarding Dutch elm disease control in Menominee County were endorsed by the Forest Pest Advisory and Steering Council of the Department of Natural Resources, and the Dutch Elm Disease Advisory Council of the Wisconsin Department of Agriculture.

### Background Information

A single verified case of Dutch elm disease was found in the community of Shawano, in Shawano County, in 1965. Other verified infected trees were found in the communities of Stratford, Wausau and Rothschild in Marathon County. Another known infection center was located 2 miles south of Kelly Lake in Oconto County. These infection centers were the closest ones known in the vicinity of Menominee County until September, 1967 when 9 cases were confirmed in the county.

Only one insect vector of the disease is known to be present in Menominee County. The American elm bark beetle, Hylurgopinus rufipes (Eichoff), has been commonly found in tops of felled trees during the first summer after cutting. Follow-up surveys of tops demonstrated that the native elm bark beetles were no longer present the second and third year following cutting.

It is difficult to predict the rate of spread of the disease in forest areas such as Menominee County. The rate of spread varies from one area to another. For example, rate of spread in Quebec, Canada ranged from 1.5 to 7 miles per year. In Connecticut the disease moved at the rate of 5 miles per year. It appears that density or spacing of elms within an area influences the intensity and progression of the disease. Present evidence does not support the concept that elm will be wiped out quickly in Menominee County. Therefore drastic changes in management practices which would encourage excessive elm removal from northern hardwood stands are not justified at this time.

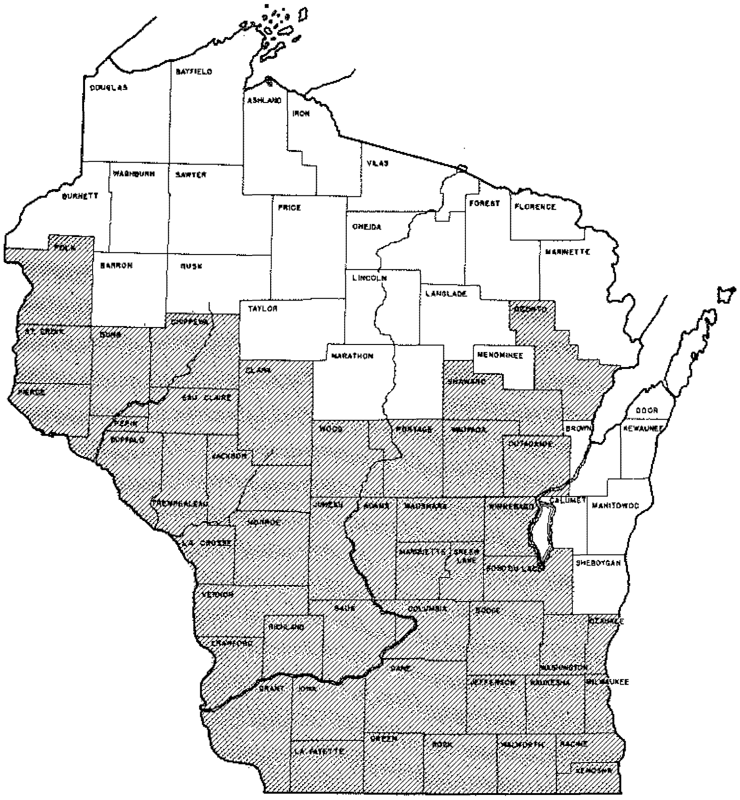
Recommendations to Menominee Enterprises, March 20, 1967:

1. Dense concentrations of elms should be mapped and observed closely for initial infection by recurrent systematic aerial and ground surveys.
2. Maintain crown separation between adjacent elms to reduce possibility of disease spread through root grafts.
3. Harvest an elm when decision factors favor equally the harvesting of an elm and another species.
4. Dispose of elm slash, as suggested by the area entomologist, to eliminate beetle breeding sites.
5. Management of swamp hardwoods should be similar to that of upland hardwoods. Swamp hardwood stands may be cut by the group-selection method. Openings up to 1/4 acre in size, resulting from group-selection cutting, are acceptable in treatment of stands threatened by Dutch elm disease.
6. Basal area levels should be maintained as recommended in present management plan.

At Devil's Lake State Park (Sauk County) a total of 87 American elms were treated with Bidrin from May 17-22. Eight of the Bidrin treated trees were determined to be infected with Dutch elm disease when sampled on August 17, 1967. It was not known if all the eight diseased trees were infected at the time of Bidrin treatments.

Oak Wilt - Ceratocystis fagacearum (Bretz) Hunt

There was no change in the statewide distribution of oak wilt in Wisconsin during 1966. The disease is present in 46 of Wisconsin's 72 counties (see map below).


DOUGLAS
BAYFIELD
ASHLAND
IRON
VILAS
WASHBURN
SAWYER
BURNETT
PRICE
FOREST
FLORENCE
ONEIDA
POLK
BARRON
RUSK
MARINETTE
LINCOLN
LANGLADE
TAYLOR
OCONTO
ST. CROIX
DUNN
CHIPPEWA
MARATHON
MENOMINEE
CLARK
SHAWANO
PIERCE
EAU CLAIRE
DOOR
PEPIN
WOOD
PORTAGE
WAUPACA
BROWN
KEWAUNEE
BUFFALO
OUTAGAMIE
JACKSON
TREMPEALEAU
JUNEAU
ADAMS
WAUSHARA
WINNEBAGO
CALUMET
MANITOWOC
MONROE
LA CROSSE
MARQUETTE
GREEN LAKE
FOND DU LAC
SHEBOYGAN
VERNON
SAUK
COLUMBIA
DODGE
OZAUKEE
RICHLAND
CRAWFORD
DANE
WASHINGTON
GRANT
IOWA
JEFFERSON
WAUKESHA
MILWAUKEE
GREEN
ROCK
WALWORTH
RACINE
LA FAYETTE
KENOSHA

Known Distribution of
Oak Wilt
1967

In the West Central Area established infections continued to spread; however, forest damage was not heavy this year. A two-acre area in Camp McCoy (Monroe County) had many new infections where brush cutting and pruning were done in early summer "to beautify" a brushy area.

Use of a cable-laying plow to break root connections was supervised at Volk Field (Juneau County) where shade trees were being lost because of root graft transmission of the fungus.

Ash Dieback - Unknown

Dieback of white ash was reported in Section 5, T13N, R6W in Vernon County. The ash, about 10 inches in diameter were growing in a mixed hardwood forest. Ash dieback was also reported in a mixed hardwood woodlot in Section 31, T12N, R8E in Columbia County.

Butternut Dieback - Melanconis juglans Berk.

Dieback and cankering of butternut was reported as being common in Grant, Iowa and Richland Counties. A survey of a 40 acre woodlot in the NE¼NE¼, Section 25, T6N, R6W of Grant County revealed that all but two butternut trees in the woodlot were cankered.

ROOT ROTS

Annosus Root Rot - Fomes annosus (Fr.) Cke.

To date Fomes annosus root rot has not been found in Wisconsin. Numerous plantations have been examined statewide in the past five years for the presence of F. annosus sporophores and root systems were examined for decay caused by F. annosus. In every plantation examined the results were negative.

Attempts were made to trap spores of F. annosus in the atmosphere from 1963-1966 using pine foliage and cheesecloth spore traps as collecting devices. The spore collections were then incubated on freshly cut pine discs. Fomes annosus was never detected in any of the spore collections.

Shoestring Root Rot - *Armillaria mellea* Vahl ex Fr.

Few infected pines were observed or reported. A Jackson County red pine plantation, NE¼SW¼, Section 33, T20N, R3W planted about 1960 in a northern pin oak area, had current mortality to about one percent of the red pines when inspected in September. The fungus had spread to pines from dead oak stumps.

## STEM AND BRANCH DISEASES

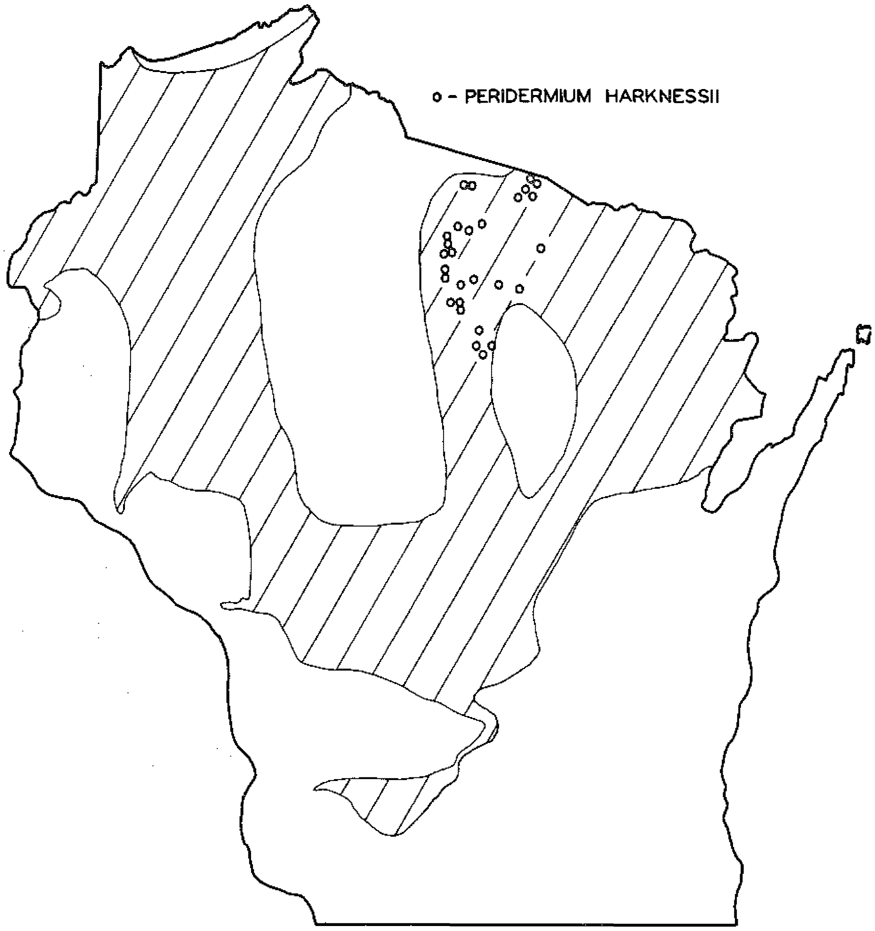
### PINE GALL RUST

Eastern Gall Rust - *Cronartium quercuum* (Berk.) Miyabe ex Shirai

Western Gall Rust - *Peridermium harknessii* J. P. Moore

A survey made from June 5 - 11 in 1967 in northeastern Wisconsin revealed that western gall rust was present on Scotch and red pines in Lincoln, Oneida and Vilas Counties. Germ tube measurements on oak leaf decoction agar indicated that western gall rust was present in 52 of 284 spore collections made at 124 different locations. Eastern gall rust was found at 101 locations, western gall rust at 17, and both species at 6 locations. Eastern and western gall rust were not found on the same tree, although such occurrences may be possible.

Survey results are portrayed on the map on page 54.


o - PERIDERMIUM HARKNESSII

Locations where western gall rust (Peridermium harknessii) infection was found in Wisconsin in 1967. Shaded area represents botanical range of jack pine in Wisconsin after P. O. Rudolf and R. L. Schoenike, 1963.

Scleroderris Pine Canker - Scleroderris lagerbergii Gremmen (perfect stage)
Brunchorstia pinea (Karst.) v. Hohn (imperfect stage)

A total of 76 red and jack pine plantations from two to ten years old were surveyed in 1967 in northern Wisconsin for the presence of Scleroderris pine canker. Counties surveyed were Ashland, Bayfield, Forest, Langlade, Marinette, Oconto, Price, Sawyer and Vilas. The only Scleroderris pine canker found was in 4 red pine plantations in Bayfield County. The infected plantations were close together, the greatest separation between plantations was 4 ½ miles. Of the infected plantations, two were county owned, one was U. S. Forest Service owned and one was owned by Nekoosa-Edwards Paper Co.

In both the Nekoosa-Edwards and the Forest Service plantations, only one infected seedling was found. The Nekoosa-Edwards plantation was in a large, definite frost pocket, but the trees had good survival and were healthy.

One of the Bayfield County plantations, located in the NW¼, Section 4, T49N, R5W, apparently has been known to be infected with Scleroderris for several years. Few live trees remain in it, and those are mostly infected. The plantation is on a knoll which is thought to have a long history of repeated burning. The soil is sand.

The other infected Bayfield county-owned planting was a 48-acre red pine plantation located in various parts of Section 35, T50N, R6W. Much of the main part of this plantation is in a hollow, which probably is a frost pocket. The most heavily infected portion (in the SE¼SE¼) is on level ground, but surrounded by taller jack pine and oak, thus may be in a man-made frost pocket.

The latter plantation was sampled by the line-plot method described by Cordell. Nineteen 20-tree plots were examined. Of those, 18 were infected. In overall summary, 31% of the trees in the plots were infected, as evidenced by the yellow-green discoloration. This included both live and dead trees. Missing trees in the plots totaled 24%, dead and dying trees 8%.

Symptoms of infection followed two patterns. In one, the trees had elongate stem cankers with the typical discoloration found on the surface of the dead wood beneath the bark. In the other, the trees had no cankers but had one or more dead branch tips, usually on the lower branches. These tips were dead and brown for about 2 or 3 inches from the end, and retained their needles. Scleroderris was indicated by the typical yellow-green color beneath the bark, markedly greenish beneath the needle fasicles. In no case was the yellow-green discoloration found in or beneath live bark, even on the edges of a canker.

Plantation records revealed that the infected plantation was planted in 1958 with 3-0 red pine from Hayward Nursery. To check the possibility that infection may have come in on nursery stock, several more 1958 Hayward-stocked plantations in the same area were checked. None were found to have Scleroderris present, although the trees were in about the same stage of development and little difference could be seen in some of the sites.

The survey in Ashland, Bayfield and Price Counties adjacent to the Chequamegon National Forest, in general, confirms the findings of the survey around the Nicolet N.F.: that Scleroderris is almost non-existant in state and county plantations of red and jack pine in the 2- to 10-year age class. The infected plantations found in northern Bayfield County, however, are an exception, and not only is Scleroderris present but it appears to be actively killing trees.

The reason for this exception is not yet understood. Presence of the disease in such a small area might be interpreted to mean that it requires some special circumstances, such as peculiar weather conditions or a nearby source of heavy inoculum in order to become destructive. The 1965 USFS survey, however, reported Scleroderris fairly uniformly scattered over the forests checked. Another possibility is that the infection in the national forests arises from their nursery stock.

Factors of site also were considered. The pines in Bayfield County, growing on sand, at nine years of age are about half the height of pines of similar age growing on better soils in Price County. However, if this were the main predisposing factor, one would expect to find more of the Bayfield plantations infected.

Frost pockets were also closely checked. The infected plantations seemed to be in frost pockets, however, nearby plantations which had very similar topography were disease-free.

White Pine Blister Rust - *Cronartium ribicola* Fischer

White pine blister rust control programs were conducted by the Wisconsin Department of Agriculture in the Black River State Forest, the Jackson County Forest, and Wildcat Mountain Park. Most of this work was *Ribes* eradication, but 9.5 acres of young plantations in the Wildcat Mountain Park and 15 acres in the Black River State Forest were pruned to remove branch cankers before they infected main stems. This practice promises multiple benefits as pruning not only removes disease infections but also improves the quality and appearance of all trees.

## FOLIAGE DISEASES

Anthracnose - *Gloeosporium* spp.

Anthracnose was reported as being widespread on black and sugar maples in Rock and Iowa Counties.

Chlorosis - Iron Deficiency

White oak chlorosis which appears to be an iron deficiency disease of white oaks growing on alkaline soils was reported in Dane and Walworth Counties. Bur oaks growing on the same sites were not affected.

Fir needle rust - Uredinopsis spp.

A needle rust of fir was reported by Christmas tree growers in Clark and Jackson Counties on July 8, 1967. On this date infected, current-year needles released clouds of aeciospores when disturbed as trees were being sheared. At the Clark County location (SESW, Section 8, T24N, R4W) both balsam fir and white fir were infected. At the Jackson County location (SWNW, Section 17, T22N, R4W) only balsam fir was infected.

Severe infections were reported on July 13 on balsam fir Christmas trees growing in Langlade (Section 23, T30N, R12E) and Shawano County (Section 18, T27N, R13E). Damage to harvestable trees was serious in the two plantations examined.

Ferns, alternate host for the disease were collected at some of the areas where the fir rust was reported. The various rusts on the ferns were tentatively identified as follows:

Clark County - (SESW, Section 8, T24N, R4W) - Balsam and white fir infected. Ferns collected on October 30, 1967. Bracken fern (Pteridium aquilinum) collected and no rust observed on the fern. No other fern species observed.

Jackson County (SWNW, Section 17, T22N, R4W) - Balsam fir infected. Uredinopsis longimucronata Faull on lady fern (Athyrium angustum). Uredinopsis mirabilis (Peck) Magn. (II, III) on sensitive fern (Onoclea sensibilis).

Langlade County - (Section 23, T30N, R12E) - Balsam fir infected. Ferns collected on July 20, 1967. Uredinopsis longimucronata Faull (II) on lady fern (Athyrium angustum). Uredinopsis mirabilis (Peck) Magn. (II) on sensitive fern (Onoclea sensibilis). Uredinopsis struthiopteridis Storm. (II) on ostrich fern (Matteuccia struthiopteridis).

Pine Needle Blight - Dothistroma pini Hulbray

Many Austrian pine Christmas tree plantations in the West Central Area are infected by this needle fungus. Some infected plantations have been cut and the area replanted to other species. These include 2 acres in Section 29 of T24N, R5W and about 3 acres in Section 30 of T24N, R5W in Jackson County.

A Christmas tree plantation of Austrian, Scotch and red pine in Sauk County (S½SW¼, Section 11, T8N, R3E) was surveyed for the presence of *Dothistroma pini* in November 1967. Every Austrian pine in the plantation was infected, but red and Scotch pine growing next to Austrian pine were free of the disease.

Brown Spot Needle Blight - *Lecanosticta acicola* (Thum) Syd.

This needle disease of pine is present in some Scotch pine plantations in west central Wisconsin and probably has been present in the state for many years in older Scotch pine plantations and shelterbelts. The fungus has not been observed on red pine, jack pine, white pine or Austrian pine in Wisconsin.

Laboratory diagnosis has confirmed the disease in Jackson and Trempealeau County Scotch pine plantations as follows.

| County | "40" | Sec. | T | R | Date |
|---|---|---|---|---|---|
| Jackson | NWSW | 8 | 21N | 5W | 6-6-66 |
| Jackson | NENE | 28 | 22N | 5W | 5-26-67 |
| Jackson | SWNW & others | 17 | 22N | 4W | 10-20-67 |
| Trempealeau | NWNE | 16 | 18N | 9W | 4-11-67 |
| Trempealeau | NESW | 7 | 24N | 7W | 9-5-67 |

Field diagnosis indicates the probability of brown spot in the following locations.

| County | "40" | Sec. | T | R | Date |
|---|---|---|---|---|---|
| Jackson | NENW | 6 | 21N | 3W | 12-19-67 |
| Jackson | SWNW | 21 | 21N | 5W | 12-19-67 |
| Monroe | NWNW | 5 | 18N | 4W | 9-7-67 |

Lecanosticta acicola was also collected on June 22, 1967 from Scotch pine Christmas trees in Portage County (NE¼, Section 33, T21N, R10E).

White Pine Needle Blight - Atmospheric Gases

White pine needle blight which is characterized by a reddish-brown discoloration of the needle tips and has been shown to be caused by atmospheric gases such as sulfur dioxide and ozone has been found in scattered areas throughout the state. A survey of white pine plantations in southern Wisconsin revealed the disease was present in almost every plantation examined.

A survey was initiated in the spring of 1967 to determine the cause of white pine needle blight in southern Wisconsin. Polyethylene bags were placed over selected branches of needle blighted trees and fastened so that atmospheric gases such as ozone would not come in contact with needles that develop that year. Needle blighted trees were bagged on May 5, 1967 at the Albany Public Hunting Grounds in Green County (SW¼SE¼, Section 16, T3N R9E) and on May 18 at the Wisconsin Dells School Forest in Adams County (SW¼SE¼, Section 36, T14N R6E).

Bagged white pine were examined at the Albany Public Hunting Grounds on June 1 and the 1967 needles had not yet emerged. On June 6 current year's needles were up to one-half-inch long on white pine growing in Dane County. The first report of white pine needle blight was received on July 10, the specimens came from the SW¼NW¼, Section 36, T6N R8E in Dane County. The current year's needles were from 1 - 2 inches long and were severely blighted.

Bagged white pines were then examined at the Albany Public Hunting Grounds on July 19 and all the newly emerged needles within the bags were green while current year's needles on unbagged branches of the same tree had typical needle blight symptoms. Bagged white pines were examined on August 3 at the Wisconsin Dells School forest and the results were the same. Bagged trees on both sites were observed throughout the summer and the current year's needles within the bags were still green when examined in October.

Thus the polyethylene bags excluded one or more atmospheric gases capable of inciting white pine needle blight. Also the periodic examination of bagged white pines indicated the conditions favorable for needle blight occurred in southern Wisconsin between June 1 and July 10.

Both the Adams and Green County sites were remote from known sources of air pollution such as automobile traffic or soft-coal burning power plants. However, the damage may be caused by naturally occurring gases such as ozone. Tobacco weather fleck which has been shown to be caused by ozone at concentrations as low as .05 ppm was observed on Wisconsin 503 tobacco growing in Dane County. Two areas in Dane County where weather fleck was observed were SW¼NE¼, Section 29, T5N R10E and SE¼NE¼, Section 29, T6N R12E.

### Chemical Injury - Air Pollution

White pine, red pine and white spruce planted on the DuPont TNT Plant property near Barksdale, Wisconsin (Bayfield County) were injured by fumes emerging from the plant's smokestack. The red pine about 3 feet tall had severely blighted needles. The white spruce 5 - 6 feet tall had variable symptoms, some were unaffected, while others had tip-burned current year's needles and many of the older needles had fallen off. Mature white pine and white pine seedlings on the plant property had typical needle blight symptoms. Aspen located on the property also showed injury in the form of black spots on the leaves. Jack pine on the property was not affected.

Needle blight on native white pine was observed on trees located up to one mile north of the plant. It is not known what chemicals were being emitted from the stack but the fumes were injuring trees located in the path of the plume.

White pine, and miscellaneous hardwoods on the edge of Devil's Lake State Park (Sauk County) were injured by fumes, containing sulfuric acid which were accidently discharged on July 15 from an oleum plant stack located in the adjacent Badger Army Ammunition plant. Trees growing within the ammunition plant property were also injured. Trees affected were white pine, red pine, oak, aspen, cottonwood, black cherry and sugar maple.

Severe damage to white pine occurred near the Wyandott Chemical Co. plant near Port Edwards (Wood County) which appeared to be associated with leaking chlorine fumes. Drift patterns were identifiable up to one mile south and east of the plant.

Trees and other plants, growing in the paths of smoke plumes from a coal-burning power plant in Buffalo County, were killed or otherwise adversely affected by exposure to combustion products escaping from the stack. Trees most severely affected included white pine, birch, hickory, oak, butternut, catalpa, poplar and sumac. Other plants injured included alfalfa, clover, corn and grape. The affected vegetation examined on September 14 was located in E½, Section 1, the N½, Section 12, T21N, R13W and the SE¼, Section 35, T22N, R13W.

Needle Droop - Rapid transpiration and limited water availability

Needle droop was reported as common in T46N, R11W of Douglas County and heaviest in 3 to 6 year old red pine plantings in Sections 27 and 28.

## NURSERY DISEASES

### Black Walnut Root Rot - Cylindrocarpon radicicola

Cylindrocarpon radicicola was found in association with root-rotted black walnut seedlings in 1966 at the State Forest Tree Nursery in Grant County near Boscobel, Wisconsin. However, there was no root rot observed on black walnut grown in the Boscobel Nursery in 1967. All the nursery seedlings lifted in the spring of 1967 and seedlings growing in the seedbeds appeared healthy. Seedbed fumigant trials were established in the fall of 1966 at the Boscobel Nursery using Methyl Bromide, Vorlex, Mylone 50D and checks. There was no significant difference in seed germination in 1967 between treatments and checks.

Cylindrocladium Root Rot - *Cylindrocladium scoparium* Morgan

Cylindrocladium root rot continues to be a problem in the state operated forest tree nurseries located at Hayward, Rhinelander and Wisconsin Rapids, Wisconsin. The disease was most prevalent on red pine transplant stock and the biggest losses occurred within a few weeks after transplanting. Soil fumigation with various chemicals has not eliminated the fungus from the soil.

Winter Injury

At the Hugo Sauer Nursery in Rhinelander thousands of 1-0 red pine seedlings turned red and died after the snow had melted in April, 1967. A similar situation occurred at the Hugo Sauer Nursery in the spring of 1966. In both cases the symptoms were typical of winter injury. Isolations made on May 3, 1967 from 1-0 and 3-0 stock ruled out any known pathogens. However, the fungus *Leptostroma* was isolated from discolored needles of 3-0 red pines.

## OTHER PROBLEMS

Red pine decline - Pentachlorophenol injury

Declining red pine (12-20 years old) growing next to pentachlorophenol-treated telephone poles were observed in numerous areas in Douglas, Langlade, Oconto, Portage and Washburn Counties.

Apparently the pine roots came in contact with the poles or material leached from the poles. There was then a dieback of the crown and many of the branches were invaded by a fungus that was identified as *Godronia* sp.

Hail Injury

Hail injury to several hundred red pine (6-10' tall) was observed in the SENW Section 34, T13N, R5E of Sauk County. Additional damage to red and white pine was observed in scattered areas in T13N, R5E. The hail storm occurred in 1966 but the damage was not reported until June, 1967 when numerous brown needles and dead branches were observed.

## Lightning Damage

Lightning damage was observed in a 40 year old white pine plantation in the Northern Highland State Forest (NW¼NE¼, Section 27, T41N, R7E) in Vilas County. A ¼ acre circular patch of white pine was completely killed by lightning and was originally mistaken as a root rot pocket. One living tree adjacent to a lightning scarred tree was cut down and examined for lightning rings in an attempt to date the lightning struck, but lightning rings were not detected.

## Salt Damage

Salt damage was most evident in the spring of 1967 on white pine growing near salted highways. Observations on other species of conifers growing along the highways showed that symptoms of brown needles were less pronounced on red and Scotch pine. Damage was not evident on balsam fir, white spruce and Norway spruce planted along highways. Also, a definite dilution effect of the salt damage was observed within increasing distance from the highway. Apparently much of the salt spray was intercepted by trees growing closest to the road. Damage was most severe where prevailing winds carried the salt spray into plantings.

In the summer of 1967 salt damage was observed throughout the state on roadside maple trees. Symptoms of the damage were smaller then normal leaves, premature coloration and top dieback.

## Winter Injury

Winter transpiration caused needle damage to white pine, white cedar and Norway spruce in a La Crosse County plantation (SE¼, Section 8, T15N, R6W). Reports of unusually severe conifer plantation loss and damage to ornamental conifers and hardwoods such as white ash and white birch came from La Crosse and Vernon Counties. A review of 1966 precipitation records from U. S.

Weather Bureau Stations revealed that Vernon County was especially dry with Hillsboro reporting only 18.52 inches of precipitation--this was 13.14 inches below normal! Reedsburg and Viroqua reported deficits of 7.47 and 8.37 inches respectively. La Crosse, Mauston, and Wisconsin Rapids reported precipitation deficits of 6 to 7 inches. Trees in these areas went into the winter with a moisture deficiency and were unable to withstand dry winter winds. White grubs feeding on red and white pine seedling roots compounded the drought injury in a Vernon County plantation (SWNE, Section 15, T14N, R1E).

## White Pine Malady - Unknown

Twenty white pine within and adjacent to a stand of black locust were found dying from the top toward the base. The lower whorls that were covered with snow in the winter of 1966-67 were green, indicating that winter injury may be a factor contributing to stem dieback. White pines growing 50 feet from the black locust were not affected. The plantation about 8 years old is located in E½, Section 28, T13N, R10E.

## MISCELLANEOUS ITEMS

Mouse damage was severe in many conifer plantations. Some Christmas tree growers reported thousands of Scotch pines damaged and lost. Counties where heaviest losses were reported were Clark, Jackson, La Crosse, Trempealeau and Vernon. Heavy mouse populations were protected from predators by the deep snow that also restricted their foraging areas.

Heavy frosts about May 23 damaged emerging oak foliage in the central counties. "Frost lines" and browned crowns were very noticeable in the Necedah area on May 25. Oak buds had not broken in Jackson, Clark and Wood Counties so trees in those areas were not damaged.

1967 was a heavy seed year for some species of trees. Elms produced huge seed crops, with a corresponding drop in foliage, resulting in requests for disease investigations.

## OTHER NOTEWORTHY DISEASES

| Organism and Disease | Host(s) |
|---|---|
| *Coleosporium solidaginis* (Schw.) Thuem<br>Needle rust | Pine, jack |
| *Chrysomyxa sp.*<br>Needle rust | Spruce, white |
| *Cryptodiaporthe castanea* (Tul.) Wehm.<br>Stem canker | Chestnut, Chinese |
| *Hypoxylon* sp.<br>Stem canker | Maple, red |
| *Rhizosphaera kalkhoffii* Bub.<br>Needle cast | Spruce, black and blue |

## MISCELLANEOUS SECTION ACTIVITIES

### PESTICIDE RESIDUES - 1967

Samples of internal body fat were collected from deer killed in Douglas, Bayfield, and Shawano Counties during the deer season, and analyzed for presence of DDT and analogues by the Pesticide Residue Laboratory of the General Laboratory Division, Wisconsin Department of Agriculture. The laboratory has provided this same type of service annually since 1962.

Seventeen samples were collected from the same general area in Douglas County as those collected in 1966. The last aerial application of DDT to the sampled area was made in the spring of 1964. Four samples had residues of 2.57, 1.91, 0.64, and 0.37 parts per million of DDT and its analogues in the body fat. No significant residues were found in the other thirteen samples from Douglas County.

Two samples were taken in the same general area but across the county line in Bayfield County. One of these samples was free of significant pesticide residue, while the other contained 0.55 ppm total DDT and DDE.

No significant pesticide residues were present in six fat samples taken from Shawano County deer.

All samples were analyzed by gas chromatrography.

### MOSQUITO CONTROL

Work continued on evaluation of nuisance mosquito species in several state parks. An application of Sevin dust in a strip about 33 feet wide along a hiking trail reduced biting activity for almost 24 hours.

### MAJOR MEETINGS ATTENDED

Central International Forest Insect and Disease Conference at Winnipeg, Manitoba.

American Phytopathological Society in Washington, D.C.